SOMAIYA VIDYAVIHAR UNIVERSITY

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

| Question No. | | Max. Marks | CO | BT |
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| Q.1 | Attempt any **THREE** of the following | | CO1 | |
| (a) | Find the Laplace transform of $f(t) = t\,e^t \sin 2t \cos t$ | 06 | | LEVEL 1 APP |
| (b) | Evaluate $\int_0^\infty \frac{\cos 6t - \cos 4t}{t} dt$ using Laplace transforms. | 06 | | LEVEL 1 APP |
| (c) | Find the inverse Laplace transforms of $\left(\frac{1}{(s-2)(s+2)^2}\right)$ | 06 | | LEVEL 1 APP |
| (d) | Find the inverse Laplace transforms of $log\left(1+\frac{1}{s^2}\right)$ | 06 | | LEVEL 1 APP |
| 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 | | LEVEL 1 APP |
| | (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 | | |

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| | (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 | | LEVEL 3 APP |
| | (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 | | |