COMP | IT | AIDS   CEC301 | ITC301 | AIC301

K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

Nov – Dec 2024
Program: B.Tech   Scheme: III
Regular Examination: SY Semester: III
Course Code: AIC301_III and Course Name: Applications of Mathematics in Engineering-I
Date of Exam: 26.11.24   Duration: 02.5 Hours   Max. Marks: 60

Instructions:
(1) All questions are compulsory.
(2) Draw neat diagrams wherever applicable.
(3) Assume suitable data, if necessary.

Q. No.	Question	Max. Marks	CO	BT leve
Q 1	Solve any **two** questions out of three: (05 marks each)	10		
a)	Find the Laplace transform of $\int_0^t u^{-1} e^{-u} \sin u \, du$		CO1	03
b)	For the function $f(x) = \begin{cases} x & ,0 < x \le \pi \\ 2\pi - x & ,\pi \le x < 2\pi \end{cases}$ in $(0, 2\pi)$ the values of constants are $a_0 = \frac{\pi}{2}, a_n = \frac{-2}{\pi n^2}[1 - (-1)^n], b_n = 0$. Then prove that $$\frac{\pi^4}{96} = \frac{1}{1^4} + \frac{1}{3^4} + \frac{1}{5^4} + \cdots \cdots$$		CO3	03
c)	Obtain the correlation coefficient from the following data <table><tr><td>X</td><td>23</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td>33</td><td>35</td><td>36</td><td>39</td></tr><tr><td>Y</td><td>18</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>28</td><td>29</td><td>30</td><td>32</td></tr></table>		CO5	03
Q 2	Solve any two questions out of three: (05 marks each)	10		
a)	Using partial fraction method, find $L^{-1}\left(\frac{s+2}{s^2(s+3)}\right)$.		CO2	03
b)	Find the orthogonal trajectories of family of curves $2x - x^3 + 3xy^2 = a$		CO4	03
c)	A random variable X has the following probability function <table><tr><td>X</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>P(X=x)</td><td>K</td><td>2k</td><td>3k</td><td>k^2</td><td>k^2+K</td><td>$2k^2$</td><td>$4k^2$</td></tr></table>Find (i) k (ii) $P(X > 5)$ (iii) $P\left(\frac{x < 5}{2 < X \le 6}\right)$		CO6	03
Q.3	Solve any **two** questions out of three. (10 marks each)	20		
a)	i) Prove that $\int_0^\infty \frac{\sin 2t + \sin 3t}{t e^t} \, dt = \frac{3\pi}{4}$	7	CO1	03
	ii) Find $L[e^{-4t} \int_0^t u \sin 3u \, du]$	3		

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b)	i) Find the Fourier series $f(x) = \begin{cases} 2, & -2 < x < 0 \\ x, & 0 < x < 2 \end{cases}$	7	CO3	03
	ii) For the function $f(x) = e^{-x}, 0 < x < 2\pi$, find a_0, a_n.	3		
c)	i) Fit a second degree parabolic curve to the following data and estimate the production in 1982	7	CO5	03

(1981)

Year(X)	1974	1975	1976	1977	1978	1979	1980	~~1991~~
Production (Y) (in tons)	12	14	26	42	40	50	52	53

	ii) Calculate Spearman's coefficient of rank correlation from the following data	3		

X	18	20	34	52	12
Y	39	23	35	18	46

Q.4	Solve any **two** questions out of three. (10 marks each)	20		
a)	i) Using convolution method, find $L^{-1}\left[\dfrac{1}{(s+3)(s^2+2s+2)}\right]$	6	CO2	03
	ii) Find $L^{-1}\left[\tan^{-1}\left(\dfrac{a}{s}\right)\right]$	4		
b)	i) Find the analytic function $f(z) = u + iv$ in terms of z by Milne Thomson method if $u - v = (x - y)(x^2 + 4xy + y^2)$	6	CO4	03
	ii) Find the constants a, b, c, d if $f(z) = x^2 + 2axy + by^2 + i(cx^2 + 2dxy + Y^2)$ is analytic.	4		
c)	i) Find the moment generating function of the following distribution	6	CO6	03

X	-2	3	1
P(X = x)	$\frac{1}{3}$	$\frac{1}{2}$	$\frac{1}{6}$

Hence find central moments. μ_1, μ_2, μ_3, μ_4.

	ii) From a city population, the probability of selecting Male or player is $\frac{7}{10}$, a male player is $\frac{2}{5}$ and a male, if a player is already selected is $\frac{2}{3}$. Find the probability of selecting (a) Non player, (b) A male, (c) A player, if male is selected first.	4		

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