APJ ABDULKALAM TECHNOLOGICAL UNIVERSITY

08 PALAKKAD CLUSTER

Q. P. Code: PE0821141-II (Pages: 3)

Name: .....

Reg. No:.....

FIRST SEMESTER M.TECH. DEGREE EXAMINATION DECEMBER 2021

Branch: Electrical and Electronics Engineering **Specialization:** Power Electronics

08EE6211 Applied Mathematics

(Common to PE)

Time:2 hour 15 minutes **Max.Marks: 60**

Answer all six questions.

Modules 1 to 6: Part 'a' of each question is compulsory and answer either part 'b' or part 'c' of each question.

Q. No.	Module 1	Marks
1.a	Determine whether the following polynomials in t over $\mathbb{R}$ are linearly dependent $x_1 = 1 + t + t^2, x_2 = -2 + 3t - 7t^2, x_2 = 4 + 8t$	3
	Answer b or c	
b	Let $v = \mathbb{R}^3$. Examine whether each of the following sets of vectors is a basis of v i) S=$\{x_1 = (1,2,3), x_2 = (2,-5,2), x_3 = (-7,5,9), x_4 = (8,-3,-4)\}$ ii) S=$\{x_1 = (1,2,1), x_2 = (2,1,0), x_3 = (1,-1,2)\}$ iii) S=$\{x_1 = (1,2,3), x_2 = (2,3,4), x_3 = (3,4,5)\}$	6
c	Construct a basis for $\mathbb{R}^3$ having (2, 0, 6, 1) and (3, 0, 7,-2) as two of its elements	6

Q. No.	Module 2	Marks
2.a	Solve the following differential equation $\frac{dz}{dx} + \left(\frac{z}{x}\right)\log z = \frac{z}{x}(\log z)^2$	3
	Answer b or c	
b	Solve $\frac{d^2y}{dx^2} - 4y = x\,sinhx$	6

c Solve $(3x+2)^2\frac{d^2y}{dx^2}+5(3x+2)\frac{dy}{dx}-3y=x^2+x-1$ 6

Q. No.	Module 3	Marks
3.a	Obtain the fourier sine transform of $f(x)=4x$ for $0<x<1$ $=4-x$ for $1<x<4$ $=0$ for $x>4$	3

Answer b or c

b If $f(x)=x$ for $0<x<\Pi/2$ 6

$=\Pi-x$ for $\Pi/2<x<\Pi$

Show that $f(x)=\frac{4}{\Pi}\left[\sin x-\frac{\sin 3x}{3^2}+\frac{\sin 5x}{5^2}-\cdots.\right]$

c Obtain the fourier expansion of $x\,sinx$ as a cosine series in (0, Π). Hence show that 6

$$\frac{1}{1.3}-\frac{1}{3.5}+\frac{1}{5.7}-\cdots=\frac{\Pi-2}{4}$$

Q. No.	Module 4	Marks
4.a	Show that $u=0.5\log(x^2+y^2)$ is harmonic and find its harmonic conjugate function	3

Answer b or c

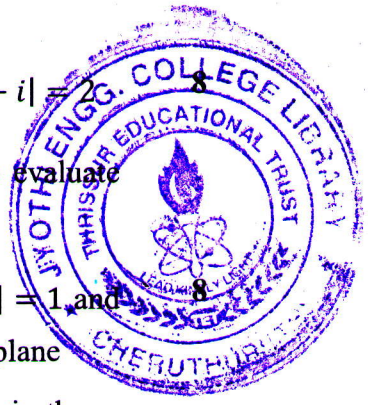
b i) Evaluate $\oint\frac{sin\Pi z^2+cos\Pi z^2}{(z-1)(z-2)}dz$ over the circle $|z|=3$ 6

ii) Evaluate $\oint\frac{e^z}{(z^2+\Pi^2)^2}dz$ over the circle $|z|=4$

c Find the Taylor's series expansion of $f(z)=\frac{2z^3+1}{z^2+z}$ about $z=i$ 6

Q. No.	Module 5	Marks
5.a	Find the Laurent's expansion of $f(z)=\frac{z}{(z-1)(z-3)}$ in the region $\|z-1\|<2$	4

Answer b or c



b	i) Evaluate Evaluate $\oint \frac{z-3}{z^2+2z+5} dz$ over the circle i) $\|z\| = 1$ ii) $\|z+1-i\| = 2$	8
	ii) Find the residue of $f(z) = \frac{z^3}{(z-1)^4(z-2)(z-3)}$ at its pole and hence evaluate $\oint f(z)dz$ over the circle $\|z\| = 2$.	5
c	i) Show that $w = \frac{1-z}{1+z}$ maps the real axis of z plane into the circle $\|w\| = 1$ and the half plane y>0 into the interior of the unit circle $\|w\| = 1$ in the w plane	8
	ii) Consider the transformation $w = ze^{i\pi/4}$ and determine the region in the w plane corresponding to the triangular region bounded by the lines $x = 0, y = 0$ and $x + y = 1$ in the w plane	

Q. No.	**Module 6**	**Marks**
6.a	Analyse the importance of unconstrained optimization technique.	**4**
	Answer b or c	
b	Minimize $f(x_1, x_2) = x_1 - x_2 + 2x_1^2 + 2x_1x_2 + x_2^2$ from the starting point $X_1 = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$ using Hooke & Jeeve's Method.	**8**
c	Explain pattern search method with a neat flow chart	**8**