U.S.N ☐☐☐☐☐☐☐☐☐☐

P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Third Semester, B.E. - Semester End Examination; Dec. - 2019

Transform Calculus Fourier series and Numerical Techniques

(Common to all Branches)

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Apply the knowledge of calculus to solve problems related to polar curves and its applications in determining the bentness of a curve.

CO2: Explain mean value theorems and evaluate the indeterminate form and power series using Taylors and Maclaurin's series.

CO3: Differentiate the function of several variables differentiate the composite function. Evaluate the vector differentiation.

CO4: Evaluate some standard integrals by applying reduction formula and solve application problems. Solve differential equations of first order and solve application problems in engineering field.

Note: I) PART - A is compulsory, one question from each unit.

II) PART - B: Answer Two sub-questions for Maximum of 18 marks from each unit.

Q. No.	Questions	Marks	BLs	COs
	I : PART - A	**10**		
I a.	Write Newton's backward interpolation formula upto fourth degree term.	2	L1	CO1
b.	Write Sterling's formula upto third terms.	2	L1	CO1
c.	Evaluate $\int (x+x^2)\cos nx\, dx$.	2	L1	CO3
d.	Define Infinite Fourier Transform and inverse Fourier Transform.	2	L1	CO4
e.	Solve: $\frac{\partial^2 z}{\partial x \partial t} = e^{-t}\cos x$	2	L1	CO4
	II : PART - B	**90**		
	UNIT - I	**18**		
1 a.	From the following table find the number of students who obtained between 40 and 45 marks. Marks: 30 – 40, 40 – 50, 50 – 60, 60 – 70, 70 – 80 No. of students: 31, 42, 51, 35, 31	9	L2	CO1
b.	Construct the interpolation polynomial for the data given below using Newton's divided difference formula. x: 2, 4, 5, 6, 8, 10 y: 10, 96, 196, 350, 868, 1746 Hence find the value of y when $x = 7$ and $x = 9$	9	L2	CO1

Contd…2

c. i) Write Gauss's backward interpolation formula up to third degree terms.

ii) Using Stirling's formulae, estimate the value of tan (16°) and from the data.

x	0	5	10	15	20	25	30
Tan(x)	0	0.0875	0.1763	0.2679	0.3639	0.4663	0.5774

9 L3 CO1

UNIT – II

18

2 a. i) Write first derivative of Newton's backward formula up to 3rd degree term.

ii) Find the maximum and minimum value of y from the data.

x:	-2	-1	0	1	2	3	4
y:	2	-0.25	0	-0.25	2	15.75	56

9 L3 CO2

b. i) Write Simpson's 3/8th rule for $n = 6$

ii) The velocity 'v' of a particle at distance 's' from a point on its path is given by the table:

X(ft)	0	10	20	30	40	50	60
V(fts^{-1})	47	58	64	65	61	52	38

Estimate the time taken to travel 60 ft by using Simpson's 1/3rd rule.

9 L2 CO2

c. Evaluate: $\int_0^1 \frac{1}{1+x^2}dx$ using Boole's rule for $n = 4$ and Weddle's rule for $n = 6$.

9 L2 CO2

UNIT - III

18

3 a. Expand the Fourier series of $f(x) = \pi^2 - x^2$ in $-\pi \le x \le \pi$ and hence deduce that,

i) $\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + ---------- \infty = \frac{\pi^2}{12}$

ii) $\frac{1}{1^2} + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + ---------- \infty = \frac{\pi^2}{6}$

9 L2 CO3

b. Obtain half range sine and cosine series of $f(x) = \begin{cases} kx, 0 \le x \le \frac{l}{2} \\ k(1-x), \frac{l}{2} \le x \le l \end{cases}$

9 L3 CO3

c. The following data gives the variations of a periodic current over a period.

t sec:	0	T/6	T/3	T/2	2T/3	5T/6	T
i amp	1.98	1.3	1.05	1.3	-0.88	-0.25	1.98

Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of the first and second harmonics.

9 L2 CO3

Contd…3

	UNIT - IV	**18**		
4 a.	If $f(x)=\begin{cases}1-x^2, \vert x\vert<1\\ 0, \vert x\vert\geq 1\end{cases}$ Find the Fourier transform of f(x) and hence find the value of $\int_0^1 \frac{x\cos x-\sin x}{x^3}dx$	9	L2	CO4
b.	i) Obtain the Fourier sine transform of the functions, $f(x)=\begin{cases}4x, & 0<x<1\\ 4-x, & 1<x<4\\ 0, & x>4\end{cases}$ ii) Find the Fourier cosine transform of $e^{-\vert x\vert}$	9	L2	CO4
c.	i) State initial value and final value theorems for Z–transform. ii) Solve difference equation $u_{n+2}+4u_{n+1}+3u_n=3^n$ with $u_0=0, u_1=1$.	9	L3	CO4
	UNIT - V	**18**		
5 a.	i) Form the PDE by eliminating arbitrary constant in $z=a\log\left(x^2+y^2\right)+b$ ii) Form the PDE by eliminating arbitrary functions $z=y^2+2f\left(1/x+\log y\right)$	9	L1	CO4
b.	i) Define linear PDE. ii) Solve $\left(z^2-2yz-y^2\right)p+\left(xy+xz\right)q=xy-xz$	9	L2	CO4
c.	Find the various possible solutions of the two dimensional Laplace's equation by the method of separation of variables.	9	L2	CO4

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