Course File

Subject Title/Subject Code: Advanced Engineering Mathematics

Semester: III Year 2023-24

Name of the Faculty: Dr. Kalpana Fatawat	
E-mail id: kalpana.fatawat@technonjr.org	

Class Schedule

Total Number of Lectures: 40

i)Course Objective

The subject aims to provide the student with:

1. Numerical methods to solve and analyze engineering problems.

2. An understanding of Fourier series and Laplace Transform to solve real world problems.

3. An understanding of Vector calculus and Linear algebra.

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VISION & MISSION OF INSTITUTE

Vision

EMPOWERING STUDENT WITH RECENT AND EMERGING TECHNOLOGIES TO CREATE INNOVATIVE TECHNICAL LEADERS
CAPABLE OF CONTRIBUTING TO INDUSTRIAL AND SOCIETAL NEEDS FOR BETTERMENT OF MANKIND ACROSS THE GLOBE.

Mission

M1: TO PROVIDE DYNAMIC LEARNING ENVIRONMENT TO STUDENTS BY PROVIDING CONSTANT EXPOSURE TO LATEST TECHNOLOGIES BY LINKING CLOSELY WITH THE INDUSTRIES.
M2: TO ESTABLISH EFFECTIVE INTERFACE WITH INDUSTRY TO OBTAIN LIVE PROBLEMS TO ENHANCE CRITICAL THINKING AND PROBLEM SOLVING SKILLS AMONG STUDENTS AND CONSULTANCY PROJECTS FOR FACULTY.
M3: TO PROVIDE AVENUES AND OPPORTUNITIES TO FACULTY FOR DOMAIN SPECIFIC TRAININGS AND QUALIFICATION UPGRADATION.
M4: TO DEVELOP ETHICAL LEADERS WITH STRONG COMMUNICATION SKILLS.

VISION & MISSION OF DEPARTMENT

Department Vision

To increase students learning of fundamentals for designing and planning of buildings and latest technologies through industry-aligned project-based learning which will help in transforming students to be good civil engineering professionals leading to innovation and incubation of new ideas.

Department Mission

M1: To create experimental learning through solving problems of Government, Society, Smart Cities, Industry and other entities.
M2: To teach the latest technologies to the students as beyond the syllabus activity so that they are updated and industry ready.
M3: To enable engineering students understand industry-aligned technologies and learn to find solutions from their early engineering days and this is the only way to produce globally relevant engineers solving real-life problems applying current technologies.
M4: To enable students to generate projects through problem faced by and requirement of Smart cities, industry, Government and other entities whereby those outlined problem statements are to be studied deeply by a group of faculty members to convert them into real-time project format.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1. To provide an in-depth understanding of the fundamentals of Civil Engineering and create a foundation for lifelong learning to facilitate a progressive career in the construction Industry, as an entrepreneur and in pursuit of higher studies.

PEO2. To equip the students with technical and analytical skills to develop innovative solutions to complex real-life problems using existing and novel technologies. To equip the students with good communication and interpersonal skills, inter-disciplinary teamwork and leadership skills to enable them to fulfil professional responsibilities.

PEO3. To expose them to various contemporary issues which will enable them to become ethical and responsible towards themselves, co-workers, Society and the Nation.

PEO4. To make the student's industry ready by imparting education related to the latest technologies so that they can grab future industry jobs.

PROGRAM SPECIFIC OUTCOMES (PSO's)

PSO1: To be aware of and initiate some-work on future technologies and new developments which may impact the future Industry 4.0.

PSO2: Hands on training on upcoming technologies and project-based learning.

PSO3: Get exposure to BIM (Building Information Modelling).

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

PO01. Engineering knowledge: Acquire the knowledge of mathematics, science, engineering fundamentals, and electronics and communication engineering, with an ability to understand, analyze and apply to the solution of engineering problems.

PO02. Problem analysis: Identify, formulate, research literature, analyse and solve electronics and communication engineering problems.

PO03. Design/development of solutions: Design solutions for electronics and communication engineering problems with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO04. Conduct investigations of complex problems: Design and conduct experiments, analyse and interpret data, and synthesize information to provide valid conclusions.

PO05. Modern tool usage: Apply appropriate techniques, resources, and modern hardware and software engineering tools to solve electronics and communication engineering problems.

PO06. The engineer and society: Apply reasoning to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO07. Environment and sustainability: Demonstrate the understanding of the impact of the professional engineering solutions in societal and environmental contexts, and need for sustainable development.

PO08. Ethics: Demonstrate the knowledge of professional and ethical responsibilities.

PO09. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10.Communication: Comprehend and communicate confidently and effectively in both verbal and written form.

PO11. Project management and finance: Apply the engineering and management principles for efficient project management.

PO12. Life-long learning: Recognize the need and acquire confidence for independent and life-long learning.

COURSE OUTCOMES (COs) OF THE SUBJECT

CO No.	Mapping	Statement
1	Understanding	Students are able to learn and use numerical methods for interpolating the data.
2	Understanding	Students are able to learn and use numerical methods for solving the transcendental and polynomial equations.
3	Applying	Students are able to solve engineering problems using Laplace Series.
4	Applying	Students are able to solve engineering problems using Fourier Series.
5	Understanding	Students are able to Solve problems in engineering domain related to Linear Algebra.

COS MAPPING WITH POs AND PSOs

Course Outcome	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	2	2	0	1	1	0	0	0	0	0	0	1	0	0	0
CO2	2	2	0	1	1	0	0	0	0	0	0	1	0	0	0
CO3	2	2	0	1	1	0	0	0	0	0	0	1	0	0	0
CO4	1	1	0	1	1	0	0	0	0	0	0	1	0	0	0
CO5	2	2	0	1	1	0	0	0	0	0	0	1	0	0	0

UNIVERSITY ACADEMIC CALENDAR

Course: Bachelor of Technology (B.TECH.) for Odd Semester				
Semester	I	III	V	VII
Induction Program	17.08.2023			
Commencement of Classes	11.09.2023	24.08.2023	04.09.2023	04.09.2023
Commencement of First Mid Term	02.11.2023	03.10.2023	05.10.2023	05.10.2023
Commencement of Second Mid Term	07.12.2023	16.11.2023	20.11.2023	20.11.2023
Last Working Day	23.12.2023	02.12.2023	02.12.2023	30.11.2023
Commencement of Practical Exams	02.01.2024	04.12.2023	23.12.2023	14.12.2023
Commencement of Theory Exams	18.01.2024	14.12.2023	08.12.2023	07.12.2023
Winter Break				

Academic Calendar Odd Semester 2022-23				
Particulars	**B.Tech-I**	**B.Tech- III**	**B.Tech- V**	**B.Tech- VII**
Commencement of classes	11-09-2023	24-08-2023	04-09-2023	04-09-2023
Last Working Day	23-12-2023	02-12-2023	02-12-2023	30-11-2023
Course Progression Report-I	25-10-2023	27-09-2023	27-09-2023	27-09-2023
First Mid Term Exam	02-11-2023	03-10-2023	05-10-2023	05-10-2023
Remedial Class-I	14-11-2024	16-10-2023	16-10-2023	16-10-2023
Course Progression Report-II	01-12-2023	10-11-2023	10-11-2023	10-11-2023
Second Mid Term Exam	07-12-2023	16-11-2023	20-11-2023	20-11-2023
Remedial Class-II	20-12-2023	29-11-2023	29-11-2023	29-11-2023
Commencement of Theory Exam	18-01-2023	14-12-2023	08-12-2023	07-12-2023
Commencement of Practical Exam	01-01-2024	04-12-2023	23-12-2023	14-12-2023

Evaluation Scheme

FACULTY DETAILS:

Name of the Faculty : Dr. Kalpana Fatawat
Designation : Asssociate Professor

Department :

1. TARGET

a) Percentage Pass : 100%
b) Percentage I class: 60 %

2. METHOD OF EVALUATION

2.1. Continuous Assessment Examinations (Mid-Term 1, Mid-Term 2)

2.2. Assignments

2.3. Quiz

2.5. Semester Examination

Others_____

3. List out any new topic(s) or any innovation you would like to introduce in teaching the subject in this Semester.

1. Take the help of creative tools to stimulate creativity. Include demonstration or forms of visual exercises that will excite the young minds and capture their interest.

Signature of Faculty: **Signature of HOD**

UNIVERSITY SYLLABUS

RAJASTHAN TECHNICAL UNIVERSITY, KOTA

SYLLABUS

II Year - III Semester: B.Tech. (Electronics & Communication Engineering)

3EC2-01: Advance Engineering Mathematics-I

3 Credits | **Max. Marks: 100 (IA:30, ETE:100)**

3L:0T:0P | **End Term Exam: 3 Hours**

SN	Contents	Hours
1	**Numerical Methods – 1:** Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Gauss's forward and backward interpolation formulae. Stirling's Formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae. Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.	10
2	**Numerical Methods – 2:** Numerical solution of ordinary differential equations: Taylor's series, Euler and modified Euler's methods. Runge- Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Solution of polynomial and transcendental equations-Bisection method, Newton-Raphson method and Regula-Falsi method.	8
3	**Laplace Transform:** Definition and existence of Laplace transform, Properties of Laplace Transform and formulae, Unit Step function, Dirac Delta function, Heaviside function, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace transforms method.	10
4	**Fourier Transform:** Fourier Complex, Sine and Cosine transform, properties and formulae, inverse Fourier transforms, Convolution theorem, application of Fourier transforms to partial ordinary differential equation (One dimensional heat and wave equations only).	7
5	**Z-Transform:** Definition, properties and formulae, Convolution theorem, inverse Z-transform, application of Z-transform to difference equation.	5
	Total	40

Office of Dean Academic Affairs
Rajasthan Technical University, Kota

PRESCRIBED BOOKS

1. Advanced Engineering Mathematics, Erwin and Kreyszig, Wiley-India
2. Advanced Engineering Mathematics, H.K. Dass, Sultan Chand & Sons.
3. Advanced Engineering Mathematics-1, Dr. Gokhroo and Dr. Jain, Unique books.

WEEKLY TIME TABLE OF THE TEACHER

Section A

Day	1	2	3	4	5	6	7
Monday		AEM					
Tuesday		AEM					
Wednesday		AEM					
Thursday	AEM						
Friday							
Saturday							

COURSE-PLAN

UNIT	Lect. No.	TOPICS	**Teaching Methods/ Teaching Aids**
	1	Finite differences	White Board, Demonstration
	2	Relation between operators	White Board, Demonstration
	3	Interpolation using Newton's forward and backward difference formula	White Board
	4	Gauss's forward and backward interpolation formulae	White Board
	5	Striling central difference formula	White Board
	6	Lagrange's Method of interpolation	White Board
	7	Newton's divided difference formula	White Board
	8	Trapezoidal rule	White Board
	9	Simpson 1\3 and 3\8 rule	White Board
	10	Doubt clearing session	White Board
	11	Tailor's series	White Board
	12	Euler and modified Euler's method	White Board
	13	Runge-Kutta Method	White Board
	14	Milne's and Adam's Prdicator and Corrector method	White Board
	15	Bisection method	White Board
	16	Newton-Raphson method	White Board
	17	Regula-Falsi method	White Board

	18	Doubt clearing session	White Board
3	19	Laplace transform	White Board
	20	Properties of Laplace transform	White Board
	21	Unit step function, Dirac delta function, Heaviside function	White Board
	22	Laplace transform of Periodic functions	White Board
	23	Laplace transform of Periodic functions	White Board
	24	Finding inverse Laplace transform	White Board
	25	Convolution theorem	White Board
	26	Evaluation of integrals by Laplace transform	White Board
	27	Evaluation of integrals by Laplace transform	White Board
	28	Solving ODE by Laplace transform	White Board
4	29	Fourier complex, sine and Cosine transform	White Board
	30	Fourier complex, sine and Cosine transform	White Board
	31	Properties and formula	White Board
	32	Inverse Fourier transform	White Board
	33	Convolution theorem	White Board
	34	Application of Fourier transforms to Partial and ordinary differential equations	White Board
	35	Application of Fourier transforms to Partial and ordinary differential equations	White Board
5	36	Z-transform -definition	White Board
	37	Properties and formulae	White Board
	38	Convolution theorem	White Board
	39	Inverse Z-transform	White Board
	40	Application of Z-transform to difference equation	White Board

Signature of Faculty: **Signature of HOD**

Assignment – 1

1. Write the definition of shift and inverse operator

2. The area A of a circle of diameter d is given for the following values:

d	80	85	90	95	100
A	5026	5674	6362	7088	7854

Find the approximate values of the areas of circles of diameters 82.

3. Use Stirling formula to find Y(28) if :

X	20	25	30	35	40
Y(x)	49225	48316	47236	45926	44306

4. Use Simpson's 1/3 and 3\8 rule to evaluate the following: integrate between 0 to 1 (dx\1+x2)

5. By using NR method, find the root of x4-x-10=0 which is nearer to x=2, correct to three places of decimal.

Assignment – 2

1. What is the finite Fourier sine transform of cos nx.
2. What is the change of scale property in Fourier transform.
3. If U(n)=3U(n-1) then find F(z).
4. What is the inverse Laplace of 1/(Z-1).
5. Solve: $dV/dt = d^2V\backslash dx^2$, x lie between –infinity to +infinity, t>0 , if V=f(x) when t=0

SAMPLE QUIZ QUESTIONS

Unit 1

1. Explain the shift operator.
2. Explain the Lagrange's interpolation formula.
3. What is simpson's 3/8 rule ?
4. When do we apply Lagrange's method ?
5. When do we apply Striling's central formula ?

Unit 2

1. Explain the Runge-Kutta fourth order method.
2. What is the value of logx for x= 4,5,6,7.
3. What will be the next value of x if bisection method is used and x1=0 and x2=1.

Unit 3

1. Define the Laplace tranformation.
2. What is the Shifting property in LT.
3. What is the inverse LT of sinh at.

Unit 4

1. What are the application of fourier transformation in the field of engineering.
2. What is the finite Fourier sine transform of cos nx.
3. What is the change of scale property in Fourier transform.

Unit 5

1. If U(n)=3U(n-1) then find F(z).
2. What is the inverse Laplace of 1/(Z-1).
3. What are the partial fractions of F(z)=1/(z-3)(z-2).

MCQ

1. To find the missing value for a data set having unequal interval, which method is appropriate:

i) Simpson 1/3 rule for unequal interval

ii) Newtons method for unequal interval

iii) Lagrange's method for unequal interval

iv) All three

v) Only ii and iii

2. μ is called:

i. shift operator

ii. average operator

iii. Sheppard operator

iv. Both b and c

3. $E = e^{hD} =?$

i) I

ii) I+Δ

iii) I+∇

iv) E+I

4. Bisection method guaranteed converges when:

i) Function is real and contiguous.

ii) Two initial guess are real.

iii) Only i

iv) Both i and ii

5. Which method is linear and slow converges

i) Bisection method

ii) Runge Kutta method

iii) Euler method

iv) Both I and ii

6. Which method has convergence of order quadratic?

i) Euler method

ii) Newton Raphson method

iii) Tayor's method

iv) Runge-Kutta method

7.

If $L\{f(t)\} = F(s) = \frac{3(s+3)}{s^2+6s+8}$, and f(0.5) is given by $K\left(\frac{e+1}{e^2}\right)$, then find the value of K

i) K=1

ii) K=2

iii) K=1.5

iv) K=0

8. The inverse Laplace of $\frac{1}{s+1}$

i) e(t)

ii) e(-t)

iii) sin t

iv) both i and ii

9.

What is the advantage of FTIR (FTIR Fourier Transform Infrared spectrometer)?

1. Improved frequency reproducibility
2. Slower operation
3. It is an easy to use, fast and versatile technique for IR sampling.
4. Solid, pastes, gels, powders, liquid can be analysed with little or no preparation.

Ans (1)

Consider a signal defined by

$$x\left(t\right)=\begin{cases}e^{\,j10t} & for\left|t\right|\leq1\\ 0 & for\left|t\right|>1\end{cases}$$

Its Fourier Transform is

1. $\frac{2\sin(\omega-10)}{\omega-10}$
2. $\frac{2e^{j10}\sin(\omega-10)}{\omega-10}$
3. $\frac{2sin\omega}{\omega-10}$
4. $\frac{e^{j10\omega}2sin\omega}{\omega}$

Concept:

The Fourier Transform of a continuous-time signal x(t) is given as:

$$X\left(\omega\right)=\int_{-\infty}^{\infty}x(t)\,e^{-j\omega t}\,dt$$

Analysis:

Given:

$x(t) = e^{j10t}$ defined from t = -1 to 1.

$$X\left(\omega\right)=\int_{-1}^{1}e^{j10t}.e^{-j\omega t}dt=\int_{-1}^{1}e^{j(10-\omega)t}dt$$

$$X(\omega)=\frac{e^{j(10-\omega)t}}{j(10-\omega)}\Big|_{-1}^{1}=\frac{2\sin(\omega-10)}{(\omega-10)}$$

Ans (1)

If the discrete-time sequence x(n), n ≥ 0 is defined to be u(n), then the Z transform X(z) is (for |z|>1):

1. $\frac{1}{z-1}$
2. $\frac{z}{z+1}$
3. $\frac{1}{z+1}$
4. $\frac{z}{z-1}$

Given x(n) = u(n)

$$X(z) = \sum_{n=0}^{\infty} z^{-n}$$

$$X(z) = \frac{1}{1-z^{-1}}$$

$$X(z) = \frac{z}{z-1}$$

Ans 4

For an LTI system, the transfer function is $H(z) = \frac{z}{(z-0.2)(z-0.5)}; |z| > 0.5$, the system is _____ and _____.

1. causal IIR, unstable
2. causal FIR, stable
3. noncausal FIR, stable
4. causal IIR, stable

Explanation

Teaching and Learning resources unit-wise:

Unit-1

https://youtu.be/xYs72hkKM1M

https://nptel.ac.in/courses/122/102/122102009/

Unit-2 https://www.youtube.com/watch?v=WlQclObEAiA

https://nptel.ac.in/courses/111/105/111105121/

Unit-3 https://www.youtube.com/watch?v=c9NibpoQjDk

https://nptel.ac.in/courses/111/105/111105123/

Unit-4 https://www.youtube.com/watch?v=lkAvgVUvYvY

https://www.youtube.com/watch?v=6spPyJH6dkQ

https://www.youtube.com/watch?v=A58pHobCLwA

Unit-5

https://nptel.ac.in/courses/108/104/108104100/

https://www.youtube.com/wch?v=Q9IKRDcN_jE

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR
B. TECH 2nd – YEAR (III SEM.) – MT- I
Advanced Engg. Mathematics (3EC201,3CE201, 3ME201)

Time: 2Hr. **Max. Marks:70**

Part- A (20 Marks)

Note:
1) The paper is divided into 2 parts: Part-A and, Part-B.
2) Part-A contains 10 questions and carries 2 mark each.
3) Part-B contains 5 questions. Each question is having two options and carries 10 marks each.

A.	Write down the formula for Sterling's central difference interpolation.	**CO1**
B.	Prove that $\Delta\ log\ log\ f(x)\ = log\ log\ \left[1+\frac{\Delta f(x)}{f(x)}\right]$	**CO1**
C.	Evaluate (E^2x^3) if h=2	**CO1**
D.	Explain the Newton-Raphson Method.	**CO2**
E.	Explain the Runge-Kutta method of fourth order.	**CO2**
F.	Write the formula for Milne's and Adam's predicator corrector method.	**CO2**
G.	Solve $u_n - 3u_{n-1} = 0,$ if $u_0 = 1,\ n \geq 1$	**CO5**
H.	Find the inverse Z-transform of $F(z)=\frac{1}{z-a}$ when $\|z\| < \|a\|$	**CO5**
I.	Find the Z –transform of discrete unit step. $u_n = 1 \quad for\ n \geq 0$ $= 0 \quad$ for $n < 0$	**CO5**
J.	Find the Z -Transform of $u_n=a^n$; $n\geq 0$	**CO5**

Part- B (50 Marks)

1.	Use Striling's formula to find y_{28} given that y_{20}= 49225 , y_{25}=48316, y_{30}=47236, y_{35}=45926, y_{40}=44306	**CO1**
	OR	

1. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using, Simpson 1\3th and 3\8th rule.	**CO1**

2. Use Runge-Kutta method of fourth order to solve $\frac{dy}{dx} = -2xy^2,\ y(0) = 1$ With $h = 0.2$. Also find approximate value of $x = 0.2$ and x=0.4.	**CO2**
OR	
2.**2**.By using Newton-Raphson method find the root of x^4-x-10=0 Which is nearer to x=2, correct to three decimal places.	**CO2**

3. Use Z-transform to solve the following equation; $u_{n+2} + 4u_{n+1} + 3u_n = 2^n$ Given $u_0 = u_1 = 0$	**CO5**
OR	
3. Find the inverse Z –transform of $F(z) = \frac{1}{(z-3)(z-2)}$ If ROC is $i)\ \|z\| < 2$ $ii)\ 2 < \|z\| < 3$ $iii)\ \|z\| > 3$	**CO5**

4. i) Find the value of $f(5)$ from the following table by using Lagrange's interpolation formula :	**CO1**

x	1	2	3	4	7
f(x)	2	4	8	16	128

ii) Taking h as the interval of differencing ,show that :

$$e^x = \left(\frac{\Delta^2}{E}\right) e^x . \frac{E e^x}{\Delta^2 e^x}$$

OR

4.Apply Milne's predicate-corrector method to solve the following differential equation: $\frac{dy}{dx} = x - y^2,$ at x=0.8 Given that Y(0)=0 | Y(0.2)=0.02 Y(0.4)=0.0795 | Y(0.6)=0.1762	**CO2**

5. A. Find the inverse Z-transform of $F(z) = \frac{z}{(z-1)(z-2)}$, $\|Z\| > 2$ **B**. Find Z-transform of $u_n = c^n \cosh an, n \geq 0$.	**CO5**
OR	
5.Use Regular-Falsi method, to find the real root of the equation $xx - 1.2 = 0$ correct to five places of decimal.	**CO2**

Marks and Gap Analysis of Mid-Term 1

Sr. No	RTU Roll Number	Name of the Student	M-1 Marks (70)	Remark (Remedial Class need or not – Y/N)
1	22ETCCE001	ANKIT KUMAR	48	N
2	22ETCCE002	ARMAAN CHAUHAN	42	N
3	22ETCCE003	AYUSH SINGH JHALA	49	N
4	22ETCCE004	PARIDHI NINAMA	58	N
5	22ETCCE005	PRAVEEN DANGI	50	N
6	22ETCCE006	ROSHNI TABIYAR	60	N

Signature of Faculty: **Signature of HOD**

TECHNO INDIA NJR INSTITUTE OF TECHNOLOGY, UDAIPUR

B. TECH 2nd – YEAR (III SEM.) – MT-III

Advance Engineering Mathematics-1 (3**EC201,** 3**CE201, 3ME201**)

Time: 3 Hr **Max. Marks:** 70

Note:

1) The paper is divided into 2 parts: Part-A and, Part-B.
2) Part-A contains 10 questions and carries 2 mark each.
3) Part-B contains 5 questions. Each question is having two options and carries 10 marks each.

Part- A (20 Marks)

A.	Evaluate L{cos at}.	CO3
B.	What is the inverse Laplace transform of 1\s-a.	CO3
C.	Write Dirichelet's conditions.	CO4
D.	Write Fourier coefficients	CO4
E.	Write the Heaviside's Unit step function and the Error function.	CO3
F.	Write the Shifting Property for Laplace transformation.	CO3
G.	Explain the Fourier transformation.	CO4
H.	Find the Fourier cosine transform of the function.	CO4
I.	Find the Z Transform of $u_n=a^n$;n≥0	CO5
J.	Solve $u_n - 3u_{n-1} = 0$, if $u_0 = 1, n \geq 1$	CO5

Part- B (50 Marks)

1. Find Laplace transform of t e(t) sin 4t.	CO3
OR	
2. Prove that L{sint/t}=tan(-1)(1\s) and hence find L{sinat/t}	CO3

3. Find inverse Laplace of (2s2-4)/(s+1)(s-2)(s-3)	CO3
OR	
4. Solve : (D2+9)y=acos3t with y(0)=b, y'(0)=c .	CO3
5. Find the Fourier sine and cosine transform of the function e(-x).	CO4
OR	
6. Find the function if Fourier transform is e(-as).	CO4
7. Solve: $dV/dt = d^2V\backslash dx^2$, if V=0 when x=0 and t is positive. V(x,t) is bounded x and t both are positive. V=0 when x is greater than equal to 1, else 1 when t=0	CO4
OR	
8. Solve: $dV/dt = d^2V\backslash dx^2$, x lie between –infinity to +infinity, t>0 if V=f(x) when t=0	CO4
9. Find the z-tranform of 9.	CO5
OR	
10. Find inverse z-transform of F(z)=z2/(z-1/4)(z-1/5).	CO5

Mid Term Exam – II

Marks and Gap Analysis of Mid-Term II

Sr. No	RTU Roll Number	Name of the Student	M-1 Marks (70)	Remark (Remedial Class need or not – Y/N)
1	22ETCCE001	ANKIT KUMAR	55	N
2	22ETCCE002	ARMAAN CHAUHAN	45	N
3	22ETCCE003	AYUSH SINGH JHALA	54	N
4	22ETCCE004	PARIDHI NINAMA	64	N
5	22ETCCE005	PRAVEEN DANGI	57	N
6	22ETCCE006	ROSHNI TABIYAR	66	N

Signature of Faculty: **Signature of HOD**

Model Question Paper

3E1206

Roll No. _____ Total No. of Pages : 3

3E1206

B.Tech. III Sem. (Main) Examination, April/May - 2022

Automobile Engineering

3AE2-01 Advance Engineering Mathematics-I

AN, AG, AE, CE, CR, EC, EI, ME, MH, PT

Time : 3 Hours **Maximum Marks : 70**

Instructions to Candidates:

Attempt all ten questions From Part A, All five Questions from Part B and three questions out of five questions from Part C .

Schematic diagrams must be shown wherever necessary. Any data missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination (As mentioned in form No.205)

PART - A

(Word limit 25)

(10×2=20)

1. Evaluate, $\Delta^6\left(ax-1\right)\left(bx^2-1\right)\left(cx^2-1\right)$

2. Prove that, $\left(\frac{\Delta^2}{E}\right)x^3=6x\left(if\ h=1\right)$

3. Using Newton-Raphson's method, find the root of $x^4-12x+7=0$ which is near to $x=2$.

4. Find the z-transform of unit impulse function which is given by $\delta_n=\begin{Bmatrix}1 & if\ n=0\\ 0 & if\ n\neq 0\end{Bmatrix}$

5. Find inverse Z Transform of $\frac{5z}{(2-z)(3z-1)}$.

6. Find the Laplace transform of $f(t)=\begin{Bmatrix}\sin t & 0<t<\pi\\ 0 & t>\pi\end{Bmatrix}$.

7. Find inverse Laplace transform of $\frac{s+2}{(s-2)^3}$

8. Write the Formulae of Fourier complex transform Fourier cosine transform and their inverse also.

9. Write the formulae of Simpson 1/3 rule and Simpson 3/8 rule.

10. By using Picard's method, solve the equation $\frac{dy}{dx} = y - x$ with $x = 0, y = 2$ upto third order of approximation.

PART - B

(Word limit 100)

1. From the following table find the number of students who obtained **(5×4=20)**

   a) Less than 45 marks.

   b) More than 45 marks.

Marks obtained:	30-40	40-50	50-60	60-70	70-80
No's of students:	31	42	51	35	31

2. Find the approximate value correct to three places of decimal of the real root of the equation $x^3 - 3x + 4 = 0$, using method of false position three times in succession.

3. Find the Fourier Sine and Cosine transform of $f(x) = \begin{bmatrix} x & for & 0<x\le 1 \\ 2-x & for & 1<x<2 \\ 0 & for & x\ge 2 \end{bmatrix}$

4. If $\bar{u}(z) = \frac{2z^2 + 5z + 14}{(z-1)^4}$ for the sequence $\{u_n\}, n \ge 0$ Evaluate u_2 and u_3.

5. Find Inverse Laplace transform of $\frac{s}{s^4 + 4a^4}$

PART - C

(Any Three) **(3×10=30)**

1. Solve $(D^2 + 9)y = \cos 2t$, given that $y(0) = 1$. $y(\pi/2) = -1$.

2. Obtain Fourier transform of $f(x) = \begin{bmatrix} x^2 & for & |x| \le a \\ 0 & for & |x| > a \end{bmatrix}$

   Hence evaluate $\int_0^\infty \cos\left(\frac{as}{2}\right)\left[\frac{(a^2s^2 - 2)\sin as + 2as\cos as}{s^3}\right] ds$

3. Solve by z transform of $u_{n+2} - 6u_{n+1} + 8u_n = 2^n + 6n$.

4. Using Milne's Predictor-Corrector Method, obtain the value of y for $x = 0.4$ for the following equation $\frac{dy}{dx} = 2e^x - y$, given that

x:	0	0.1	0.2	0.3
y:	2	2.01	2.04	2.09

5. A slider in a machine moves along a fixed straight rod. Its distance x(cm) along the rod is given below for various values of time t(sec)

$t \Rightarrow$	0	0.1	0.2	0.3	0.4	0.5	0.6
$x \Rightarrow$	30.28	31.43	32.98	33.54	33.97	33.48	32.13

Evaluate

i) Velocity for t = 0.1, 0.5 and 0.3

ii) Acceleration for t = .02, .33 and .58

Techno India NJR Institute of Technology

(Approved by AICTE, New Delhi and Affiliated to Rajasthan Technical University Kota (Raj.))

RESULT ANALYSIS

S.NO.	RTU ROLL NUMBER	NAME OF STUDENT	END TERM MARKS	SESSIONAL MARKS	TOTAL
		MAX MARKS	**70**	**30**	**100**
1.	22ETCCE001	ANKIT KUMAR	27	22	49
2.	22ETCCE002	ARMAAN CHAUHAN	0	19	19
3.	22ETCCE003	AYUSH SINGH JHALA	2	22	24
4.	22ETCCE004	PARIDHI NINAMA	15	26	41
5.	22ETCCE005	PRAVEEN DANGI	11	23	34
6.	22ETCCE006	ROSHNI TABIYAR	18	27	45

TOTAL	PASS	FAIL	ABSENT	PASS %
6	3	3	0	50

Indirect Assessment:

Overall Teacher Self Assessment (at the completion of course) in terms of course objective and outcomes

At the completion of course I find that the set outcomes (see course outcome table) were achieved at the satisfactory level.

Methodology to identify bright student

I follow very simple techniques of observation and interaction. I observe the intellectual level of the students by asking simple questions which are basics of the mathematics and interact with them regularly. I Pay attention to each and every students to know how they are utilizing their brain to perform the different tasks or activities.

Efforts to keep students engaged

I start my lecture by asking school level problems and move towards the topic to be taught. In between I ask short questions to which they can answer by looking at their notes, so that they can remember. One problem I solve with the help of the students and at the end I conduct MCQ. If I am continuing topic taught in previous class, I start with making students recalling it and ask MCQ questions.