B.A./B.Sc. THIRD YEAR MATHEMATICS SYLLABUS

SEMESTER – VI, PAPER – VII-(A)

ELECTIVE-VII(A); LAPLACE TRANSFORMS

60 Hrs

UNIT – I (12 hrs) Laplace Transform I : -

Definition of - Integral Transform – Laplace Transform Linearity, Property, Piecewise continuous Functions, Existence of Laplace Transform, Functions of Exponential order, and of Class A.

UNIT – 2 (12 hrs) Laplace Transform II : -

First Shifting Theorem, Second Shifting Theorem, Change of Scale Property, Laplace Transform of the derivative of f(t), Initial Value theorem and Final Value theorem.

UNIT – 3 (12 hrs) Laplace Transform III : -

Laplace Transform of Integrals – Multiplication by t, Multiplication by t^n – Division by t. Laplace transform of Bessel Function, Laplace Transform of Error Function, Laplace Transform of Sine and cosine integrals.

UNIT –4 (12 hrs) Inverse Laplace Transform I : -

Definition of Inverse Laplace Transform. Linearity, Property, First Shifting Theorem, Second Shifting Theorem, Change of Scale property, use of partial fractions, Examples.

UNIT –5 (12 hrs) Inverse Laplace Transform II : -

Inverse Laplace transforms of Derivatives–Inverse Laplace Transforms of Integrals – Multiplication by Powers of 'P'– Division by powers of 'P'– Convolution Definition – Convolution Theorem – proof and Applications – Heaviside's Expansion theorem and its Applications.

Reference Books :-

1. Laplace Transforms by A.R. Vasistha and Dr. R.K. Gupta Published by Krishna Prakashan Media Pvt. Ltd. Meerut.
2. Fourier Series and Integral Transforms by Dr. S. Sreenadh Published by S.Chand and Co., Pvt. Ltd., New Delhi.
3. Laplace and Fourier Transforms by Dr. J.K. Goyal and K.P. Gupta, Published by Pragathi Prakashan, Meerut.
4. Integral Transforms by M.D. Raising hania, - H.C. Saxsena and H.K. Dass Published by S. Chand and Co., Pvt.Ltd., New Delhi.

Suggested Activities:

Seminar/ Quiz/ Assignments

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THIRD YEAR . B. A, B. Sc, DEGREE EXAMINATIONS

SEMISTER . IV: CHOICE BASED CREDIT SYSTEM

PARTIII, MATHEMATICS

ELECTIVE – VII(A): LAPLACE TRANSFORMS

(NEW SYLLABUS W. E. F. 2015 – 16)

PART – A

Answere any five of the following questions $5 \times 5 = 25.$

(1)Define the function of exponential order

(2)Define change of sclar property

(3) Laplace transform of integral.

(4)If $F(t) = t^2, 0 < t < 2$ *and* $F(t+2) = F(t)$ *then find* $L\{F(t)\}$.

(5)*Find* $L\{t^2 \cos at\}$.

(6)*Evaluate* $L^{-1}\left\{\dfrac{e^{-3s}}{(s-4)^2}\right\}$.

(7)*Prove that* $L^{-1}\left\{\tan^{-1}\dfrac{2}{s^2}\right\} = \dfrac{2}{t}\sin t \sin ht$.

(8)*Evaluate* $L^{-1}\left\{\dfrac{4s+5}{(s-1)^2(s+2)}\right\}$.

PART – B

Answere all questions $5 \times 10 = 50$

(9)(*a*)*Suppose* $F(t)$ *is piecewise continuty in every finite interval and is of exponential order a as* $t \to \infty$. *Then f exists* $\forall\ s > a$.

(*or*).

(*b*) *State and prove linear property.*

(10)(*a*) *State and prove Second Shifting theorem.*

(*or*)

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(b) Prove that $L\{J_0(t)\} = \frac{1}{\sqrt{s^2+1}}$ and hence deduce that

(i) $L\{tJ_0(at)\}$, (ii) $L\{e^{-at}J_0(at)\}$.

(11)(a) State and prove Initial value theorem.

(or)

(b) prove that $L\{c(t)\} = \frac{\log(s^2+1)}{2s}$.

(12)(a) State and prove Convolution theorem.

(or)

(b) Find $L^{-1}\left\{\frac{1}{(s-1)^5(s+2)}\right\}$

(13)(a) Using Heavi – sides expansion formula, find $L^{-1}\left\{\frac{3s+1}{(s-1)(s^2+1)}\right\}$.

(or).

(b) Showthat $\int_0^\infty \sin x^2 \, dx = \frac{1}{2}\sqrt{\frac{\pi}{2}}$.

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B.A./B.Sc. THIRD YEAR MATHEMATICS SYLLABUS,
SEMESTER – VI, CLUSTER – A, PAPER – VIII-A-1
Cluster Elective- VIII-A-1: INTEGRAL TRANSFORMS

60 Hrs

UNIT – 1 (12 hrs) Application of Laplace Transform to solutions of Differential Equations : -

Solutions of ordinary Differential Equations.
Solutions of Differential Equations with constants co-efficient
Solutions of Differential Equations with Variable co-efficient

UNIT – 2 (12 hrs) Application of Laplace Transform : -

Solution of simultaneous ordinary Differential Equations.
Solutions of partial Differential Equations.

UNIT – 3 (12 hrs) Application of Laplace Transforms to Integral Equations : -

Definitions : Integral Equations-Abel's, Integral Equation-Integral Equation of Convolution Type, Integro Differential Equations. Application of L.T. to Integral Equations.

UNIT –4 (12 hrs) Fourier Transforms-I : -

Definition of Fourier Transform – Fourier's in Transform – Fourier cosine Transform – Linear Property of Fourier Transform – Change of Scale Property for Fourier Transform – sine Transform and cosine transform shifting property – modulation theorem.

UNIT – 5 (12 hrs) Fourier Transform-II : -

Convolution Definition – Convolution Theorem for Fourier transform – parseval's Indentify – Relationship between Fourier and Laplace transforms – problems related to Integral Equations.

Finte Fourier Transforms : -

Finte Fourier Sine Transform – Finte Fourier Cosine Transform – Inversion formula for sine and cosine Transforms only statement and related problems.

Reference Books :-

1. Integral Transforms by A.R. Vasistha and Dr. R.K. Gupta Published by Krishna Prakashan Media Pvt. Ltd. Meerut.
2. A Course of Mathematical Analysis by Shanthi Narayana and P.K. Mittal, Published by S. Chand and Company pvt. Ltd., New Delhi.
3. Fourier Series and Integral Transforms by Dr. S. Sreenadh Published by S.Chand and Company Pvt. Ltd., New Delhi.
4. Lapalce and Fourier Transforms by Dr. J.K. Goyal and K.P. Gupta, Published by Pragathi Prakashan, Meerut.
5. Integral Transforms by M.D. Raising hania, - H.C. Saxsena and H.K. Dass Published by S.Chand and Company pvt. Ltd., New Delhi.

Suggested Activities:

Seminar/ Quiz/ Assignments

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SEMISTER . IV: CHOICE BASED CREDIT SYSTEM

PARTIII, MATHEMATICS

CLUSER ELECTIVE – VII – A – 1: INTEGRAL TRANSFORMS

(NEW SYLLABUS W. E. F. 2015 – 16)

PART – A

Answere any five of the following questions $5 \times 5 = 25.$

(1)*Using Laplace transform method, solve* $y''(t) + y(t) = t$, *given that* $y'(0) = 1$, $y(\pi) = 0$

(2)*Solve* $\frac{d^2y}{dx^2} + y = 0$ under the condition that $y = 1, \frac{dy}{dt} = 0$, *when* $t = 0$

(3)Apply Laplace transform to solve $\frac{dy}{dx} - \frac{dy}{dt} = 1 - e^{-t}, 0 < x < 1, t > 0,$ *given that* $y(x, 0) = x$

(4)*Solve the Integral equation* $F(t) = 1 + \int_0^t F(u)\sin(t-u)du.$

(5)*Convert the integral equation* $F(t) = t^2 - 3t + 4 - 3\int_0^t (t-u)^2 F(u)du$ *into differential equation and associated condition.*

(6)*Relationship between Fourier transform and Laplace transform*

(7)*Show that the Fourier transform of* $f(x) = e^{\frac{-x^2}{2}}$ *is* $\sqrt{2\pi}\ e^{\frac{-s^2}{2}}$.

(8)*State and prove parsevals identity for fourier transform.*

PART – B

Answere all questions $5 \times 10 = 50$

(9)(a)*Using Laplace transform method* $\frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 5y = (\cos t - \sin t)e^{-2t},$ *subject to the boundary conditions* $y(0) = 1, y'(0) = -3$

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(or).

(b) Solve $(D^4 - 1)y = 1$, when $y = Dy = D^2y = D^3y = 0$.

(10)(a) Solve $(D-2)x - (D+1)y = 6e^{3t}$

$(2D-3)x + (D-3)y = 6e^{3t}$, $x(0) = 3$, $y(0) = 0$.

(or)

(b) Solve $\frac{dy}{dt} = 2\frac{d^2y}{dx^2}$ if $y(0,t) = 0 = y(5,t), y(x,0) = 10\sin 4\pi$

(11)(a) Solve $\int_0^t \frac{F(u)du}{\sqrt{t-u}} = 1 + t + t^2$.

(or)

(b) Solve $F'(t) = t + \int_0^t F(t-u)\cos u\, du$, $F(0) = 4$.

(12)(a) Findthe fourier transform of $f(x) = \begin{cases} 1-x^2 & , |x| < 1 \\ 0 & , |x| < 1 \end{cases}$ and hence

evaluate $\int_0^\infty \left(\frac{x\cos x - \sin x}{x^3}\right)\cos\frac{x}{2}\, dx$.

(or)

(b) Find the sine transform of $\frac{x}{1+x^2}$

(13)(a) Find the inverse Fourier transform of $\overline{f(s)} = e^{-|s|y}$

where y belongs to $(-\infty, \infty)$.

(or).

(b) Using Fourier integral formula, show that $e^{-x}\cos x = \frac{2}{\pi}\int_0^\infty \frac{(u^2+2)\cos ux}{u^4+4}\, du$.

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B.A./B.Sc. THIRD YEAR MATHEMATICS SYLLABUS
SEMESTER – VI: PAPER – VIII-A-2
ELECTIVE – VIII-A-2: ADVANCED NUMERICAL ANALYSIS

60 Hrs

Unit – I (10 Hours)

Curve Fitting: Least – Squares curve fitting procedures, fitting a straight line, nonlinear curve fitting, Curve fitting by a sum of exponentials.

UNIT- II : (12 hours)

Numerical Differentiation: Derivatives using Newton's forward difference formula, Newton's backward difference formula, Derivatives using central difference formula, stirling's interpolation formula, Newton's divided difference formula, Maximum and minimum values of a tabulated function.

UNIT- III : (12 hours)

Numerical Integration: General quadrature formula on errors, Trapozoidal rule, Simpson's 1/3 – rule, Simpson's 3/8 – rule, and Weddle's rules, Euler – Maclaurin Formula of summation and quadrature, The Euler transformation.

UNIT – IV: (14 hours)

Solutions of simultaneous Linear Systems of Equations: Solution of linear systems – Direct methods, Matrix inversion method, Gaussian elimination methods, Gauss-Jordan Method ,Method of factorization, Solution of Tridiagonal Systems,. Iterative methods. Jacobi's method, Gauss-siedal method.

UNIT – V (12 Hours)

Numerical solution of ordinary differential equations: Introduction, Solution by Taylor's Series, Picard's method of successive approximations, Euler's method, Modified Euler's method, Runge – Kutta methods.

Reference Books :

1. Numerical Analysis by S.S.Sastry, published by Prentice Hall India (Latest Edition).
2. Numerical Analysis by G. Sankar Rao, published by New Age International Publishers, New – Hyderabad.
3. Finite Differences and Numerical Analysis by H.C Saxena published by S. Chand and Company, Pvt. Ltd., New Delhi.
4. Numerical methods for scientific and engineering computation by M.K.Jain, S.R.K.Iyengar, R.K. Jain.

Suggested Activities:

Seminar/ Quiz/ Assignments

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PARTIII, MATHEMATICS

CLUSER ELECTIVE – VII – A – 2: ADVANCED NUMARICAL ANALYSIS

(NEW SYLLABUS W. E. F. 2015 – 16)

PART – A

Answere any five of the following questions $5 \times 5 = 25$.

(1)*Certain experimental values of x&y are given bellow*

x	0	2	5	7
y	-1	5	12	20

If " a_0+a_1x "*find the approximation values of* a_0 & a_1 +

(2)*From the following table of values of* x *and* y *, obtain* $\frac{dy}{dx}$&$\frac{d^2y}{dx^2}$ *for* $x = 1.5$.

x	1.5	2.0	2.5	3.0	3.5	4.0
y	3.375	7.0	13.625	24.0	38.875	59.0

(3)Computethe first derivative for the following table of data $x = -3 \& x = 0$

x	-3	-2	-1	0	1	2	3
y	-33	-12	-3	0	3	12	33

(4)*Evaluate* $\int_0^1 x^3\,dx$ *with five sub intervals by trapezoidal rule.*

(5)*Evaluate the integral* $\int_4^{5.2} \log x\,dx$.

(6)*Solve the equations* $2x_1 + x_2 + x_3 = 10$, $3x_1 + 2x_2 + 3x_3 = 18$ *and*

$x_1 + 4x_2 + 9x_3 = 16$ *using Gauss – elimination method.*

(7)*Solve the equations* $10x + y + z = 12$, $2x + 10y + z = 13$ *and* $x + y + 5z = 7$

by Gauss – Jordan method.

(8)*Find the values of* y *for* $x = 0.4$ *by picards method , given that* $\frac{dy}{dx} = x^2 + y^2$,

$y(0) = 0$.

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PART – B

Answere all questions $5 \times 10 = 50$

(9)(a) Find the curve of best fit of the type $y = ae^x$ to the following data by the method of of least squares

x	1	5	7	9	12
y	10	15	12	15	21

(or).

(b) Fit a function of the form $Y = A_1 e^{\lambda_1 x} + A_2 e^{\lambda_2 x}$ to the data by using a sum ofexponentials.

(10)(a) Compute $f'(4)$ from the following table using Newtens divided difference formula.

x	1	2	4	8	10
y	0	1	5	21	27

(or)

(b) Use stirlings formula to find $f'(1.22)$ from the following table

x	1.0	1.1	1.2	1.3	1.4
y	0.84147	1.89121	0.93204	0.96356	0.98545

(11)(a) Find the value of $\int_1^2 \frac{dx}{x}$ by simpsons rule. Hence obtain approximate value of $\log_e 2$

(or)

(b) Evaluate $I = \int_1^{\frac{\pi}{2}} \sin x \, dx$ using Eulers – Meclaurines formula.

(12)(a) Solve the following system by the method of factorization(Triangularization)

$2x - 3y + 10z = 3$, $-x + 4y + 2z = 20$ and $5x + 2y + z = -12$.

(or)

(b) Solve the following system of equationsby Jacobi &Gauss – scidel methods correct to 3 – decimal places $x + y + 54z = 110$, $27x + 6y - z = 35$ and $6x + 15y + 2z = 72$.

(13)(a) Given $\frac{dy}{dx} = \frac{y - x}{y + x}$, $y(0) = 1$, compute $y(0.1)$ in steps of 0.02 using

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Eulers modified method.

(*or*).

(*b*) *Use* $R-K$ *method to evaluate* $y(0.1)\&y(0.2)$ *given that* $y'=x+y\,,y(0)=1$

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SEMISTER . IV: CHOICE BASED CREDIT SYSTEM

PARTIII, MATHEMATICS

CLUSER ELECTIVE – VII – A – 3:PROJECT WORK

(NEW SYLLABUS W. E. F. 2015 – 16)

PROJECT WORK: 100MARKS

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PROJECT WORK

Project work in mathematics or in mathematics-related subjects is now very common,especially in applied or statistical topics. Everyone knows projects aregenerally beneficial to the students.To delve deeply into a topic of interest by finding and studying an article or part of a book on that topic and then writing a report,which should include some mathematical analysis and numerical computations.The project report and presentation make 20 percent of our course grade and more importantly,is our opportunity to learn about a concept of interest that involves some aspect ofanalysis.

Report guidelines:We take a project to be a substantial piece of written work (mini-thesis), in which the student has some element of choice over topic. The report should be roughly 15-20 pages, double-spaced, using word or some other appropriate format. There are individual assignments under the supervision of a member or staff. The report should include theoretical or computational significance inmathematics, but may also include less technical explanations and relevant historical or scientific background (who developed the method,why the method was developed,how its usage is, etc.)

Source:-You should use at least two sources of information,which may include your text book, other booksand scholarly articles.You should not rely on any website as a main source of information, but searching the web may help initially as an idea-generator to create interest on topics and for basic information.

Assessment: We have argued that depth of understanding, especially of proofs,plays a more central role in projects.For this reason we think the viva should be a required part of the assessment.The viva is also

needed to reward the student who has substantiated the topic in a material form, for example, the web, but used it logically and with understanding, and penalize the student who has lifted mindlessly. The main assessment of the written report, often supplemented by contributions from an oral presentation, along with a book of work progress, poster presentation etc.

For each selected problem, a good presentation of data would include.

- A description of the problem and numerical method.
- One table showing the errors resulting from all the different methods.
- One graph showing the numerical solutions.
- One graph showing the errors.
- A writeup explaining your results and analysis of what is happening with the different methods and why.
- A copy of your codes in the appendix.

For example: project name:Numerical differentiation and integration

Abstract:

Keywords:

Introduction:

We will normally evaluate the derivative or integral of a simple function by using calculus.When the functions are complicated, we have to apply some numerical techniques to obtain the approximate values for their derivatives and integrals.

Conclusion:

References:

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