

A.P. State Council of Higher Education
Semester-wise Revised Syllabus under CBCS, 2020-21

Course Code:

Four-year B.A. /B.Sc. (Hons)
Domain Subject: **MATHEMATICS**
IV Year B.A./B.Sc.(Hons)– Semester – V

Max Marks: 100

Course-7B: Integral Transforms with Applications
(Skill Enhancement Course (Elective), 5 credits)

I. Learning Outcomes:

Students after successful completion of the course will be able to

1. Evaluate Laplace transforms of certain functions, find Laplace transforms of derivatives and of integrals.
2. Determine properties of Laplace transform which may be solved by application of special functions namely Dirac delta function, error function, Bessel function and periodic function.
3. Understand properties of inverse Laplace transforms, find inverse Laplace transforms of derivatives and of integrals.
4. Solve ordinary differential equations with constant/ variable coefficients by using Laplace transform method.
5. Comprehend the properties of Fourier transforms and solve problems related to finite Fourier transforms.

II. Syllabus :(Hours: Teaching: 75 (incl. unit tests etc.05), Training: 15)

Unit – 1: Laplace Transforms- I (15h)

1. Definition of Laplace transform, linearity property-piecewise continuous function.
2. Existence of Laplace transform, functions of exponential order and of class A.
3. First shifting theorem, second shifting theorem and change of scale property.

Unit – 2: Laplace Ttransforms- II (15h)

1. Laplace Transform of the derivatives, initial value theorem and final value theorem. Laplace transforms of integrals.
2. Laplace transform of $t^n \cdot f(t)$, division by t , evolution of integrals by Laplace transforms.
3. Laplace transform of some special functions-namely Dirac delta function, error function, Bessel function and Laplace transform of periodic function.

Unit – 3: Inverse Laplace Transforms - I (15h)

1. Definition of Inverse Laplace transform, linear property
2. First shifting theorem, secondshifting theorem, change of scale property
3. Use of partial fractions.

Unit – 4: Inverse Laplace Transforms - II

1. Inverse Laplace transforms of derivatives, inverse Laplace transforms of integrals
2. Multiplication by powers of 'p', division by 'p'.
3. Convolution, convolution theorem proof and applications.

Unit – 5: Applications of Laplace Transforms (15h)

1. Solutions of differential equations with constants coefficients
2. Solutions of differentialequations with variable coefficients.
3. Applications of Laplace transforms to integral equations- Abel's integral equation.

III. Text Book: A.R. Vasistha, Dr. R.K. Gupta, Laplace Transforms, Krishna Prakashan Media Pvt. Ltd. Meerut.

Reference Books:

1. Dr. S. Sreenadh, S. Ranganatham, Dr. M.V.S.S.N. Prasad, Dr. V. Ramesh Babu, Fourier series and Integral Transforms, S. Chand & Company, Pvt. Ltd., Ram Nagar, New Delhi-110055.
2. M.D. Raisinghania, H.C. Saxena, H.K. Dass, Integral Transforms, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
3. Dr. J.K. Goyal, K.P. Gupta, Laplace and Fourier Transforms, Pragathi Prakashan, Meerut.
4. Shanthi Narayana, P.K. Mittal, A Course of Mathematical Analysis, S. Chand & Company Pvt. Ltd. Ram Nagar, New Delhi-110055.
5. Web resources suggested by the teacher and college librarian including reading material.

3. Co-Curricular Activities:

A) Mandatory:

1. For Teacher: Teacher shall train students in the following skills for 15 hours, by taking Relevant outside data (Field/Web).

1. Demonstrate on sufficient conditions for the existence of the Laplace transform of a function.
2. Evaluation of Laplace transforms and methods of finding Laplace transforms.
3. Evaluations of Inverse Laplace transforms and methods of finding Inverse Laplace transforms.
4. Fourier transforms and solutions of integral equations.

2. For Student: Fieldwork/Project work; Each student individually shall undertake Fieldwork/Project work and submit a report not exceeding 10 pages in the given format on the work-done in the areas like the following, by choosing any one of the aspects.

1. Going through the web sources like Open Educational Resources on Applications of Laplace transforms and Inverse Laplace transforms to find solutions of ordinary differential equations with constant /variable coefficients and make conclusions. (or)
2. Going through the web sources like Open Educational Resources on Applications of convolution theorem to solve integral equations and make conclusions. (or)
3. Going through the web source like Open Educational Resources on Applications of Fourier transforms to solve integral equations and make conclusions.

4. **Suggested Format for Fieldwork/Project work Report:** Title page, Student Details, Index page, Stepwise work-done, Findings, Conclusions and Acknowledgements.

5. **Unit tests (IE).**

b) Suggested Co-Curricular Activities:

1. Assignments/collection of data, Seminar, Quiz, Group discussions/Debates
2. Visits to research organizations, Statistical Cells, Universities, ISI etc.
3. Invited lectures and presentations on related topics by experts in the specified area.

4. **Suggested Question Paper Pattern:**

Max.Marks:75

Time:3 hrs

SECTION – A

(Answer any **five questions**. Each answer carries 5 Marks)

5 X 5=25

1. Find $L\{(\sin t - \cos t)^2\}$

2. Find $L\{e^t \cos^2 t\}$

3. Find $L\{t^2 \cos 3t\}$

4. Find $L\left\{\frac{1 - e^t}{t}\right\}$

5. Find $L^{-1}\left\{\frac{s+1}{s^2+6s+25}\right\}$

6. Find $L^{-1}\left\{\frac{e^{-5s}}{(s-2)^4}\right\}$

7. Find $L^{-1}\left\{\log\left(1 + \frac{1}{s^2}\right)\right\}$

8. Find $L^{-1}\left\{\frac{1}{s^3(s^2+1)}\right\}$

9. Solve $(D^2+2D+2)y = 0$, if $y=Dy=1$ when $t=0$.

10. Solve the integral equation $F(t) = 1 + 2 \int_0^t F(t-u)e^{-2u} du$

SECTION - B

(Answer ALL the questions. Each question carries 10 Marks)

5 X 10 =50

11. Find $L\{\sin \sqrt{t}\}$

(OR)

12. State and prove second shifting theorem in Laplace Transform

13. Prove that $\int_0^{\infty} t^3 e^{-t} \sin t \, dt = 0$

(OR)

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

15. Find $L^{-1}\left\{\frac{4s+5}{(s-4)^2(s+3)}\right\}$

(OR)

16. Find $L^{-1}\left\{\frac{s^2}{s^4 + 4a^4}\right\}$

17. Find $L^{-1}\left\{\frac{s}{(s^2 + 1)(s^2 + 4)}\right\}$ by using convolution theorem

(OR)

18. State and prove convolution theorem.

19. Solve $(D^2 + 9)y = \cos 2t$, if $y(0) = 1$, $y\left(\frac{\pi}{2}\right) = -1$.

(OR)

20. Solve the integral equation $F(t) = e^{-t} - 2 \int_0^t \cos(t-u) F(u) \, du$.

Recommended Question Paper Pattern and Model
BLUE PRINT FOR QUESTION PAPER PATTERN

Semester - V

Unit	S.A.Q(including choice)	E.Q(including choice)	Total Marks
I	2	2	30
II	2	2	30
III	2	2	30
IV	2	2	30
V	2	2	30
	10	10	150

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

Short answer questions : 5 X 5 M = 25 M

Essay questions : 5 X 10 M = 50 M

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Total Marks = 75 M