DEPARTMENT OF MATHEMATICS

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	**Mathematics for Production Engineers**		
Course Code	**MAIR35**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**NIL**		
Session	**July 2019**	**Section (if, applicable)**	**B**
Name of Faculty	**Dr. A. Purusothaman**	**Department**	**MATHEMATICS**
Email	**apurusoth@nitt.edu**		
Name of Course Coordinator(s) (if, applicable)	**----------**		
E-mail	**apurusoth@nitt.edu**	**Telephone No.**	**9944317732**
Course Type	**Core course**		

Syllabus (approved in BoS)

Laplace Transforms of standard functions, derivatives and integrals –Inverse Laplace transform – Convolution theorem- Periodic functions –Application to ordinary differential equations and simultaneous equations with constant coefficients and integral equations.

Fourier Transforms, relationship between Fourier transform and Laplace transform, properties of Fourier transforms, Fourier Cosine and sine transforms- Inverse transforms- Convolution theorem and Parseval's identity for Fourier transforms.

Newton's forward, backward and divided difference interpolation – Lagrange's interpolation – Numerical Differentiation and Integration – Trapezoidal rule – Simpson's 1/3 and 3/8 rules – Curve fitting – Method of least squares and Newton-Raphson method for $f(x,y)=0$ and $g(x,y)=0$.

Numerical solution of Ordinary Differential Equations – Euler's method – Euler's modified method – Taylor's method and Runge-Kutta method for simultaneous equations and 2nd order equations – Multistep methods – Milne's and Adam's methods.

Numerical solution of Laplace equation and Poisson equation by Liebmann's method – solution of one dimensional heat flow equation – Bender – Schmidt recurrence relation – Crank – Nicolson method – Solution of one dimensional wave equation.

Reference Books

1. Grewal, B.S., Higher Engineering Mathematics, 43rd Edition, Khanna Publishers, Delhi, 2013.
2. Kreyszig, E., Advanced Engineering Mathematics, 10th Edition, John Wiley and Sons, 2010.
3. Veerarajan, T., Engineering Mathematics (for First Year), Tata McGraw Hill Edition, New Delhi, 2005.
4. Gerald, C.F. and Wheatley, P.O., Applied Numerical Analysis, Addison Wesley, 2010.
5. Jain, M.K., Iyengar, S.R. and Jain, R.K., Numerical Methods for Scientific and Engineering Computation, New Age International, 2012.
6. Jain, M.K., Iyengar, S.R. and Jain, R.K., Computational Methods for Partial Differential Equations, 2nd Edition, New Age International, 2016.
7. Veerarajan, T., Numerical Methods, Volume III, Tata McGraw Hill Edition, New Delhi, 2009.

COURSE OBJECTIVES

To apply the basics of Laplace transforms to solve fluid and general engineering problems.

A broad introduction to some important mathematical derivations of some functions and their derivatives using Fourier Transforms.

To apply various numerical computational techniques to solve various engineering problems

COURSE OUTCOMES (CO)

Course Outcomes	Aligned Programme Outcomes (PO)
1. Understanding and applying the methodologies to solve the ordinary differential equations(ODEs), simultaneous equations with constant coefficients and integral equations using Laplace transforms.	Students will apply their knowledge of Mathematical techniques to solve industrial problems
2. Understanding the basic concepts of determining Fourier transforms, inverse Fourier transform, and Fourier cosine and sine transform with their inverse transforms of some useful functions.	"
3. Understanding and applying methods for the interpolation of engineering data (two dimensional) with equal/unequal interval, numerical differentiation and integration and to find the best fit curve.	Students will apply their knowledge of Numerical techniques to solve industrially applicable problems
4. Understanding the basic concepts of solving ODEs and its applications to Production Engineering problems.	"
5. Understanding and applying the numerical methods to compute the numerical solutions of Partial Differential Equations with error controls and their applications to thermal, fluid and general engineering problems.	"

COURSE PLAN – PART II

COURSE OVERVIEW

- To have general awareness and understanding of
  (1) Various formulas involved in Laplace transforms of several functions in view of solving differential and integral equations.
  (2) Fourier trandforms of various functions and convolution theorem.
- To impart the basic concepts of interpolation of two-dimensional data.
- To understand and obtain various numerical solutions of ODEs and PDEs with error analysis.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
1	Week- 1	Introduction to Laplace transform(LT) and its applications, Definition, Existence of Laplace transform, Examples, Properties of LT, LT of some functions, First translation theorem and inverse LT of some functions.	Chalk and Talk
2	Week- 2	Derivatives and Integrals of LT, Convolution theorem-statement and proof, LT of periodic functions, LT of derivatives of f(t).	Chalk and Talk
3	Week- 3	Solutions of ordinary differential equations, simultaneous differential equations and integral equations by using Laplace transform.	Chalk and Talk
4	Week- 4	Introduction to Fourier transform(FT) and its applications, Definition, Inverse FT, Formulas, Relationship between FT and LT, Properties of FT and some problems.	Chalk and Talk
5	Week- 5	Convolution theorem for FT, Parseval's identity for FT, FT and Inverse FT of some functions, Fourier cosine and sine transforms and their Inverse transforms.	Chalk and Talk
6	Week- 6	Properties of Fourier cosine and sine transforms, Solving problems, Transform methods to evaluate integrals, Introduction to interpolation and its applications, Derivation of Newton's forward and backward formulas and some practical problems.	Chalk and Talk

7	Week- 7	Newton's divided difference and Lagrange's interpolation formulas, Some problems, Solving problems using numerical differentiation.	Chalk and Talk
8	Week- 8	Some problems using Trapezoidal rule, Simpson's 1/3 and 3/8 rules, Curve fitting-method of least squares and Newton-Raphson method for solving f(x, y) = 0 and g(x, y) = 0.	Chalk and Talk
9	Week- 9	Introduction to numerical solution of ordinary differential equations (ODE's), Euler's method, Euler's modified method, some problems and Taylor's series method for simultaneous ODEs.	Chalk and Talk
10	Week- 10	Runge-Kutta method for simultaneous ODEs, Taylor's series and Runge-Kutta methods for second order ODEs, Some problems to be solved.	Chalk and Talk
11	Week- 11	Introduction to multistep methods and their advantages, Derivation of Milne's predictor-corrector formula, error term, Some problems, Adam's predictor-corrector method and solving some problems.	Chalk and Talk
12	Week- 12	Introduction to Finite difference method, Finite difference formulas and the errors involved in these formulas and Computing numerical solutions of Laplace equation by Liebmann's procedure.	Chalk and Talk
13	Week- 13	Numerical solution of Poisson equation by Liebmann's technique, Derivation of explicit formula, Bender-Schmidt recurrence formula, Crank-Nicolson implicit formula for solving one-dimensional heat flow equation (Parabolic equation) and computing numerical solutions.	Chalk and Talk
14	Week- 14	Derivation of explicit scheme to compute numerical solution of one-dimensional wave equation (Hyperbolic equation) and some problems.	Chalk and Talk

COURSE ASSESSMENT METHODS (shall range from 4 to 6)				
S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Cycle Test – I	7th week	One Hour	20
2	Cycle Test – II	13th week	One Hour	20
3	Assignment - I	4th week	21 Days	5
4	Assignment - II	8th week	21 Days	5
CPA	Compensation Assessment: Retest	14th week	One Hour	20
5	Final Assessment: End Semester Exam	Last week of November, 2018	Three Hours	50

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

1. Feedback from students during class committee meeting.
2. Anonymous feedback through questionnaire (as followed previously by the Institute).

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, , academic honesty and plagiarism etc.)

1. Faculty can also be contacted over phone: 9944317732. E-mail: apurusoth@nitt.edu
2. Cycle test-I and Cycle test-II will be conducted in regular class.
3. Portions for Cycle test-I are Unit-I and Unit-II (First and Second paragraphs of syllabus).
4. Portions for Cycle test-II are Unit-III and Unit-IV (Third and Fourth paragraphs of syllabus).
5. Students who have missed the first or second or both cycle test(s) can register with the faculty concerned for the Re-Test examination which shall be conducted soon after the completion of the second cycle test. The Re-Test shall be conducted for 20 marks comprising the syllabus of both first and second cycle tests. The Re-Test shall be conducted before the regular semester examinations.
6. At least 75% attendance in each course is mandatory. Students with less than 75% in any course by the end of 9th week will be identified and alerted by the class committee.

7. **Students who have failed in the semester examination with 'F' grade and those have missed the End semester examination due to genuine/medical reason shall take Reassessment (supplementary examination). One Reassessment (for 100 marks) will be conducted within 10 days from reopening of Institute for next semester. Students should register their names with the course teacher to appear for reassessment within three days from the reopening of Institute for next semester. If the students satisfy the criteria fixed by the faculty to promote 'E' grade will be given 'E' grade and others given 'F' grade.**

8. **Students awarded 'V' grade must compulsorily redo the course.**

9. **The passing minimum should be maximum of 35 or $\frac{\bar{x}}{2}$ where $\bar{x}$ is the mean of the class.**

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HOD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

  The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION

Faculty is available for discussion after the class hours at the Department on the first floor of Lyceum. Room No. 206.

FOR APPROVAL

Course Faculty _____ CC-Chairperson _____ HOD _____

(Dr. A. Purusothaman) (Dr. V. Satheeshkumar) (Dr. P. Sathiya)