**NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI**

**This course outline template acts as a guide for writing your course outline. As every course is different, please feel free to amend the template/ format to suit your requirements.**

| **COURSE OUTLINE TEMPLATE** | | | |
|---|---|---|---|
| **Course Title** | **Mathematics for Production Engineers** | | |
| **Course Code** | **MAIR35** | **No. of Credits** | **3** |
| **Department** | **Mathematics** | **Faculty** | **Dr. R. Ponalagusamy** |
| **Pre-requisites Course Code** | **MA101 and MA102** | | |
| **Course Coordinator(s) (if, applicable)** | **NIL** | | |
| **Other Course Teacher(s)/Tutor(s) E-mail** | **NIL** | **Telephone No.** | **7402448889** |
| **Course Type** | **Core course** | | |

**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 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.<br><br>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.<br><br>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.<br><br>4. Understanding the basic concepts of solving ODEs and its applications to Production Engineering problems.<br><br>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. | The engineering under-graduates will apply their knowledge of Mathematical and numerical techniques to solve industrially applicable problems. |

**COURSE TEACHING AND LEARNING ACTIVITIES**

| S.No. | Week | Topic | Mode of Delivery |
|---|---|---|---|
| 1. | Week- 1<br><br>Week- 2<br><br>Week- 3 | 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.<br><br>2. Derivatives and Integrals of LT, Convolution theorem-statement and proof, LT of periodic functions, LT of derivatives of f(t).<br><br>3. Solutions of ordinary differential equations, simultaneous differential equations and integral equations by using Laplace transform. | Chalk and Talk |

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| **2.** | **Week- 4** | **4. Introduction to Fourier transform(FT) and its applications, Fourier integral theorem, Definition, Inverse FT, Relationship between FT and LT, Properties of FT and some problems.** | **Chalk and Talk** |
| | **Week- 5** | **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.** | |
| | **Week- 6** | **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.** | |
| | **Week- 7** | **7. Newton's divided difference and Lagrange's interpolation formulas, Some problems, Solving problems using numerical differentiation.** | |
| | **Week- 8** | **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.** | |
| | **Week- 9** | **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.** | |
| | **Week- 10** | **10. Runge-Kutta method for simultaneous ODEs, Taylor's series and Runge-Kutta methods for simultaneous differential equations and second order ODEs, Some problems to be solved.** | |
| | **Week- 11** | **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.** | |
| | **Week- 12** | **12. Introduction to Finite difference method, Derivation of finite difference formulas and the errors involved in these formulas and Computing numerical solutions of Laplace equation by Liebmann's procedure.** | |

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| **3.** | **Week- 13**<br><br><br><br><br><br>**Week- 14** | **13. Numerical solution of Poisson equation by Liebmann's technique, Derivation of explicit formula, Bender-Schmidt recurrence formula and Crank-Nicolson implicit formula for solving one-dimensional heat flow equation and computing numerical solutions.**<br><br>**14. Derivation of explicit scheme to comput numerical solution of one-dimensional wave equation and some problems.** | **Chalk and Talk** |

**COURSE ASSESSMENT METHODS**

| S.No. | Mode of Assessment | Week/Date | Duration | % Weightage |
|---|---|---|---|---|
| **1.** | **Cycle Test – I** | **7th week** | **1 Hour** | **20%** |
| **2.** | **Cycle Test- II** | **12th week** | **1 Hour** | **20%** |
| **3.** | **Retest** | **14th week** | **1 Hour** | |
| **4.** | **Assignments** | | | **10%** |
| **5.** | **End Semester Exam** | | **3 Hours** | **50%** **Total : 100 Marks** |

**ESSENTIAL READINGS : Textbooks, reference books Website addresses, journals, etc**

**Reference Books**


1. Grewal, B.S., Higher Engineering Mathematics, 42nd Edition, Khanna Publications, Delhi, 2012.
2. Kreyszig, E., Advanced Engineering Mathematics, 8th Edition, John Wiley and Sons, 2008.
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, Wiley Eastern, 2010.
6. Veerarajan, T., Numerical Methods, Volume III, Tata McGraw Hill Edition, New Delhi, 2009.

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| COURSE EXIT SURVEY (mention the ways in which the feedback about the course is assessed and indicate the attainment also) |
| 1. Feedback from students during class committee meeting.<br>2. Anonymous feedback through questionnaire (as followed previously). |
| COURSE POLICY (including plagiarism, academic honesty, attendance, etc.) |
| 1. Test-I and Test-II will be conducted in regular class.<br>2. 75% attendance is compulsory for writing the end semester examination. |
| ADDITIONAL COURSE INFORMATION:<br><br>Faculty is available for discussion after the class hours at the Department on the first floor of Lyceum. Room No. 222. Faculty can also be contacted over phone: 7402448889 |
| **eg.:** The Course Coordinator is available for consultation at times that are displayed on the coordinator's office notice board. Queries may also be emailed to the Course Coordinator directly at ---------- |
| FOR SENATE'S CONSIDERATION |
| Course Faculty 8/7/2016 CC-Chairperson HOD 8/7/2016 |

Dr. K. MURUGESAN
Professor and Head
Department of Mathematics
National Institute of Technology
Tiruchirappalli - 620 015.