

# TEMPLATE FOR COURSE SPECIFICATION (Applied Mathematics)

## HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW

### COURSE SPECIFICATION

This course introduces students to Solve:- linear equations of the first order; linear equations with constant coefficients; variation of parameters; undetermined coefficients; linear independence; exact equations; separation of variables; and applications: systems of linear differential equations; solution by power series; solution of Laplace transforms; partial differential equations; boundary value problems; numerical methods.

At the end of the course students should be able to apply these methods to tackle all kinds of problems that appear in chemical engineering.

1. Teaching Institution	University of Technology
2. University Department/Centre	Chemical Engineering Department
3.Course title/code	Applied Mathematics/331
4.Programme(s) to which it contributes	CE.331
5.Modes of Attendance offered	Full time
6.Semester/Year	2 semester/year
7. Number of hour tuition(total)	3
8. Date of production/revision of this Specification	2016/6/7
9. Aims of the Course	
<ul style="list-style-type: none"><li>• Introduce the students to formulate of differential equations which represent the chemical engineering problems.</li><li>• Give students skills of solving ordinary differential equations.</li><li>• Introduce students to formulae the partial differential equations and solving them using different methods.</li></ul>	

## **10• Learning Outcomes, Teaching, Learning and Assessment Method**

### **A-Knowledge and Understanding**

At the conclusion of this course, students should be able to:

- A1. Solve all types of first and second order ordinary differential equations.
- A2. Solve chemical engineering application problems using first order linear equations.
- A3. Solve differential equations using series solutions.
- A4. Solve differential equations using Laplace Transforms.
- A5. Formulate partial differential equations of different chemical engineering applications.
- A6. Solve partial differential equations by separation of variables, combination of variables, Laplace transform methods.

### **B-Subject-specific skills**

- B1. Apply the principles of Heat and Mass balance for desired chemical Engineering problems.
- B2. Formulating of differential equations (ordinary and partial) of any process using reasonable assumptions.
- B3. Solving simultaneous differential equations at a certain boundary conditions to obtain the process variables as a function of position and time.

### **Teaching and Learning Methods**

**Lectures:** Two hours lectures per week will be given to students.  
**Tutorials:** one hour per week.  
**Laboratories:** Two hours per week.  
**Case Study:** Some practical case studies will be given during the course.  
**Assignments:** One assignment will be given by the end of each lecture.

### **C. Thinking Skills**

An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern engineering tools to a range of engineering activities, from simple to complex, with an understanding of the associated limitations

### **Teaching and Learning Methods**

Discussion, problem solving, student questions, Lectures, Tutorials, Weekly homework problems, Practical Applications, Special problems.

### **Assessment methods**

Midterm exams, Final exam, Quizzes, Weekly homework, weekly Laboratory exam, report of solving special problems, open questions that have a definite answer, or do not have definite answer.

## D. General and Transferable Skills (other skills relevant to employ ability and personal development).

D1. Work together in same-discipline teams to solve engineering mathematical problems.

D2. To review state-of-the-art concepts for static and dynamic modeling systems.

D3. Speed intuitive, predictability and drive the mathematical model equations of chemical engineering problems.

## 11.Course Structure

Week	Hours	ILOs	Unit/Module or Topic Title	Teaching Method	Assessment Method
<b>1<sup>st</sup> semester</b>					
1	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	<b>Reviews solution methods of 1<sup>st</sup> and 2<sup>nd</sup> ordinary differential equations (linear and nonlinear, homogeneous, ...etc).</b>	Lectures, Practical Applications	partial test (Oral questions :- multiple choice )
2	3	Ability to develop understanding of issues related to the applied mathematics to	<b>Solution of heterogeneous 2<sup>nd</sup> ordinary differential equations.</b>	Lectures , Example Classes , Practical Applications	Exams , Weekly homework, Open questions that have a definite answer , or do not have a definite answer.
3	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	<b>Mathematical Statement of the Problem</b> Representation of the problem, Absorption with chemical reaction	Lectures, Tutorials , Example Classes , Practical Applications	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
4	3	Ability to develop understanding of issues related to the applied mathematics to	Reaction in a spherical and cylindrical catalyst	Lectures, Tutorials , Example Classes , Practical Applications	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
5	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	Radial heat transfer through a cylindrical conductor, Simultaneous diffusion and chemical reaction in a tubular reactor	Lectures, Tutorials , Example Classes , Practical Applications	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
6	3	Ability to develop understanding of issues related to the applied mathematics to the chemical engineering	<b>Solution by Series</b> Infinite series by Taylor theorem	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)

7	3	Ability to develop understanding of issues related to the applied mathematics to	Method of Frobenius (Case I)	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
8	3	Ability to develop understanding of issues related to the applied mathematics to	Method of Frobenius (Case II)	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
9	3	Ability to develop understanding of issues related to the applied mathematics to the chemical engineering problems.	Method of Frobenius (Case IIIa)	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
10	3	Ability to develop understanding of issues related to the applied mathematics to	Method of Frobenius (Case IIIb)	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
11	3	Ability to develop understanding of issues related to the applied mathematics to the chemical engineering problems.	Bessels's and Modified Bessel's Equation	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
12	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	Properties of Bessel Functions,	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
13	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	Applications in chemical engineering	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)

14	3	Ability to develop understanding of issues related to the applied mathematics to the chemical engineering problems.	Tubular Gas Preheater	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
15	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	Reaction in axisymmetric Spherical and Cylindrical pellets.	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
16	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	<b>Laplace Transformation</b> Definition of Laplace Transformation	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
17	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	Inverse Transform, Properties of the Laplace Transformation	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
18	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	The Step Functions, Convolution, Inversion by Elementary Integration	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
19	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	Inversion by Residual Method	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
20	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	Applications in Chemical Engineering.	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
21	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	<b>Partial Differential Equations</b> Interpretation of Partial Derivatives	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)

22	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	Formulating of Partial Derivatives, Typed of boundary Conditions,	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
23	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	Solutions of Partial Differential Equations by Combination of Variables Method	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
24	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	Solutions of Partial Differential Equations by Combination of Variables Method	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
25	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	Solutions of Partial Differential Equations by Laplace Method.	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
26	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	Finite Differences Nonlinear mathematics for 1st & 2nd order ordinary differential equations, Symbolic Operators, Backward Difference Operator, Forward	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
27	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	The Average Operator, Difference Equation and Their Solutions	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
28	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	Interpolations of Equally Spaced Points , Interpolations of Equally Spaced Points	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
29	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	Applications in Finite Difference Equation, Linear Finite Difference Equations,	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)

30	3	Ability to develop understanding of issues related to the applied mathematics to the chemical	Non-Linear Difference Equations and Their Solutions.	Finite	Lectures, Tutorials , Example Classes , Weekly homework problems	Exams , Weekly homework, Team and homework problems , Open questions that have a definite answer , (Oral questions)
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12.Infrastructure	
Required reading: ·CORETEXTS ·COURSEMATERIALS ·OTHER	1) “Mathematical Methods in Chemical Engineering”, Jenson. V.J. and Jeffereys, G.V, 2nd Edition, Academic Press New York, 1977. 2) “Applied Mathematics and Modeling for Chemical Engineers”, Rice R G. and. Do, D. D., John Wiley and Sons, New York, 1995. 3) “Applied Mathematical Methods for Chemical Engineers”, Loney, Norman W., 2nd edition, CRC Press – Taylor & Francis Group, Boca Raton, 2007.
Special requirements(include for example workshops, periodicals, IT software, websites)	Websites
Community-based facilities (include for example, guest Lectures, internship, field studies)	Field trips

13. Admissions	
Pre-requisites	Before undertaking this module the student should have undertaken the following: Basic Principles of chemical engineering I and II, Mathematics I & II.
Minimum number of students	Central Admission
Maximum number of students	Central Admission