Course Specifications of  
Mathematics III – B211 2008/2009

Faculty: **Benha Faculty of engineering**  
University: Banha

Program on which the course is given : All programs  
Major or minor elements of program : N.A.  
Departments offering the program : All departments  
Department offering the course : Department of Basic Science  
Academic year/level : Second year- First semester  
Date of specification approval : / / 2009

---

### A - Basic Information

Title : Mathematics  
Code : B211  
Credit Hours : N.A.  
Lecture : 3  
Tutorial : 2  
Lab : 0

### B – Professional Information

1. **Overall aims of the course**

   By the end of this course the student will be able to:
   
   - Form a differential equation through the elimination of arbitrary constants or expressing some physical phenomena.
   - Classify a differential equation regarding its order, degree and linearity.
   - Solve a first order differential equation and obtain the orthogonal trajectories.
   - Obtain the general solution of an \( n \)th order differential equation with constant coefficients and with variable coefficients in the Euler form.
   - Obtain the general solution of an \( n \)th order linear differential equation with constant coefficients using variation of parameters.
   - Obtain the solution of a system of linear differential equations.
   - Evaluate integrals leading to a Gamma or a Beta function.
   - Recognize and graph quadratic surfaces in \( \mathbb{E}^3 \).
   - Deal with vector functions of one real variable.
   - Obtain the domain and range of a real function of two and three real variables.
   - Obtain the partial derivatives of a function of several variables.
   - Obtain the directional derivative and the total differential and apply them on to obtain the tangent plane and the normal line to a surface.
   - Obtain the Taylor expansion of a function of two variables and apply it to the estimation of errors.
   - Solve optimization problems in several dimensions.
   - Solve constrained optimization problems in several dimensions using Lagrange’s multipliers.

2. **Intended Learning outcomes of the course**

   (a) **Knowledge and understanding**
   
   (i) Acquire knowledge for subsequent courses in mathematics.
   (ii) Acquire tools for introductory and advanced engineering courses.

   (b) **Intellectual skills**
   
   (i) Develop prerequisite analytical skills for subsequent courses in mathematics.
   (ii) Acquire familiarity with modeling physical and engineering problems.
3. Contents

<table>
<thead>
<tr>
<th>Topic</th>
<th>No of hours</th>
<th>Lecture</th>
<th>Tutorial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classification, formation and types of solutions of ode</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Solution of first order ode – orthogonal trajectories</td>
<td>10</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>n-th order homogeneous differential equations with constant coefficients</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Particular solution of non-homogeneous differential equations by operators</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Variation of parameters - Euler equation – Reduction of order</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Systems of linear differential equations</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Gamma and Beta functions</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Curves and surfaces in three dimensions</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Vector functions of one variable</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Scalar functions of several variables – Partial derivatives</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Directional derivatives – Total derivatives – Tangent planes – Normal lines</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Taylor expansions – Error and approximation</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Maximums, minimums and saddle points – Lagrange’s multipliers</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>Optimization problems</td>
<td>5</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

4. Teaching and learning methods
   (a) Lectures (power point presentation recommended)
   (b) Class tutorials

5. Students’ assessment methods
   (a) Midterm examination
   (b) Assignments and quizzes
   (c) Final examination

5.1 Assessment schedule
Weekly

5.2 Weighting of assessments
   Class participation and attendance 10%
   Assignments and quizzes 10%
   Midterm examination 20%
   Final examination 60%

6. List of references
   (i) Lecture Notes
       Ordinary Differential Equations I Staff members
       Multivariable Calculus I   Staff members
   (ii) Reference Books
       Thomas and Finney Latest edition

7. Facilities required for teaching and learning
   Data show – projector
   Course Coordinator
   Head of Department