Prince Sultan University
College: DES
First Semester 2017-2018(171)

INSTITUTIONAL COURSE SYLLABUS TEMPLATE

Course Code : **Math 221**
Course Title : Numerical Analysis
Pre-requisite :Math101

Name of Faculty: **Dr. Muhammad Dure Ahmad**
Credit Hours : 3 hours

MISSION STATEMENT

The mission statement of General Courses Department *is to provide PSU students with diverse educational opportunities by delivering high quality courses in social, health , and physical sciences that help students develop* intellectual hard skills in these domains and interpersonal and transferable soft skills, such as *critical thinking and analytical, management and communication skills. These capacities will empower students to achieve success across the academic programs at Prince Sultan University, to gain professional competencies for the workplace, as well as to become multi-talented and valuable community members of the society.*

I. Course Description:

In this course, students will review and learn mathematical techniques necessary for success as an engineer, both in future coursework and on the job. Given the difficulty of solving more realistic engineering problems analytically, the emphasis will be on the understanding and use of computational algorithms. In the process, students will develop a strong working knowledge of software packages like Matlab, Maple, and Mathematica, which are integrated technical computing environments that combine numeric computation, advanced graphics and visualization, and a high-level programming language.

II. Course Objectives:

1.0	**Knowledge**
1.1	Implement suitable numerical algorithm to compute differentiation and integration of data and function.
1.2	Compute eigenvalue / eigenvector using power method and solution of system of linear equations using Jacoby and Gauss Seidel Method.

2.0	**Cognitive Skills**
2.1	Explain the consequences of finite precision and error analysis in Numerical Methods.
2.2	Demonstrate understanding and implementation of numerical algorithms applied to interpolation techniques and

	curve fitting.
2.3	Use Numerical techniques to solve initial value problems and boundary value problems.

3.0	**Interpersonal Skills & Responsibility**
3.1	Use appropriate method to find the roots of non-linear functions and polynomials and perform error analysis.

Course Goals:

- Introduce basic concepts in scientific computing
- Explain how, why, and when numerical methods are expected to work
- Provide a firm basis for future studies in scientific computing
- Provide simulation tools for scientific and engineering problems.

Course Outline/Main Topics:

- Mathematical preliminaries and error analysis
- Solving nonlinear equations in one variable
- Interpolation and polynomial approximation
- Numerical differentiation and integration
- Initial value problems for ordinary differential equations
- Direct methods for solving linear system of equations
- Iterative techniques in matrix algebra

IV. Course Components

Component	**Contact Hours**
Lecture	3
Tutorial	1

V. Teaching Strategies

Domain	**Strategy**
Knowledge	Lectures, Concept presentation..
Cognitive Skills	Drill work , Lectures, Concept presentation
Interpersonal Skills & Responsibility	Example presented in the class , Lectures, Concept presentation
Numerical & Communication Skills	Practice Sheets Problem Solving questions

VI. Course Requirements : Course – reports , examinations , quizzes , assignments

VII. Student Assessment

A. Assessment Task

Domain	**Assessment Task**
Knowledge	-Major Exams , Final Examination, Quizzes
Cognitive Skills	-Assignments , Major Exams & Final Examination
Interpersonal Skills & Responsibility	Class Participation & Attendance, Major Exams , Final Examination, Quizzes
Numerical & Communication Skills	Oral, Written Tests and Assignments

B. Schedule of Assessment

Assessment	Assessment Task	Week Due	Proportion of Final Assessment
1	Quizzes	On Regular Basis	10%
2	Assignment	3,6,9,12,15	15%
3	Major-1	7	15%
4	Major-2	14	15%
7	Participation	Throughout the semester	5%
8	Final exam		40%

VIII. Learning Resources

Textbook: R. L. Burden and J. D. Faires, Numerical Analysis, Brooks/Cole, 9th ed., 2011.

Notes Website: Holistic Numerical Methods at http://mathforcollege.com/nm/

B. Facilities Required - lecture room, computing resources.

C. Learning Management System –Should use LMS

- **Grading system**

Grading policy and Evaluation Criteria:

Students are expected to reading and do assignments as they are assigned. Graded work will include two in-class major exams as well as quizzes and homework and computer projects. Each homework will be assigned at least one day before it is due. Quizzes will be announced at least one day before they are given. Each of the two in-class exams will be announced at least one week before it is given. The final grade will be calculated using the following weights:

- Homework and Computer projects: 15%
- Quizzes: 10%
- Two in-class Tests: 35 %
- Final exam: 40%.

Students work on quizzes, in-class exams, and the final exam alone. It will be announced prior to each exam and quiz what aids (books, notes, calculators, etc.), if any, students will be permitted to use on that exam or quiz. Handed in homework may be discussed with other students as well as with the instructor. However, in writing up an assignment to be handed in, the student works alone (without other students or other students' papers) and certifies that what is written accurately represents the student's own understanding of the material.

Missed Work:

If a student fails to take an exam or quiz or fails to hand in an assignment on time, his/her score is zero unless the reasons for the failure are serious and beyond the student's control. The instructor reserves the right to verify that the reasons are serious and beyond the student control. It is to the student's advantage to inform the instructor of such reasons before missing the work.

When work is missed for such reasons, the instructor, after consultation with the student, will decide how to handle the missed work.

Class attendance:

- Students are required to attend all classes starting from the first day of the semester. Attendance will be taken at the start of the lecture. If the student enters the classroom after the attendance was taken and within **5 minutes,** he will be marked **late.** 3 lates will be counted as one absence. If the student enters the classroom **after 5 minutes,** he will be marked **absent.**
- **No excuses for missing classes, including medical reasons, are accepted.** Any excuse, legitimate or not, will be counted against the student's limit for DN (13 Absences).
- "**DN Grade**" will be issued to a student who **misses 13 classes**. This means he cannot enter any more classes or exams. **(1st warning: 5 absences ; 2nd warning: 9 absences)**
- In case a student **misses** a class, he must contact any one of his classmates to get all information and topics covered of classes he **missed.**

Matlab:

Matlab from http://www.mathworks.com/ is going to be the programming language for this class. Good Matlab programming skills can go a long way to earn the student a descent grade in this class. The student could also use other software packages to write programs such as Scilab from http://www.scilab.org/, or FreeMat from freemat.sourceforge.net/.

Lectures and printed notes:

You should read through and understand your notes **before** the next lecture... otherwise you will get hopelessly lost. Please, do not hesitate to interrupt me whenever you have questions or if I am inaudible, illegible, unclear or just plain wrong. If you feel that the course is too difficult, or that you are spending too much time on it, please come and talk to me. Please, do not wait until the end of term to give a feedback if you are unhappy with some aspects of the course.

Detailed printed notes will be posted on PSU LMS for you to print out, read and bring in class, so that you can listen to me and make the most of the lectures, rather than having to write down every sentence on paper. However, the notes provided should only be used as a supplement, not as an alternative to your personal notes. These printed notes are an addition to lectures and are not meant to be used independently. With a few exceptions, **notes worked examples are deliberately omitted** when working out class examples. The aim being that going through the examples at least once will help you to learn the material. (It might also help you to stay awake if you have to write something down from time to time).

Examples I will provide will help you to understand the material taught in the lectures and will give you practice on the types of questions that will be set in the examination. **It is very important that you try out notes Examples before the example classes**.

Tentative Lecture Schedule

Week#	*Date*	Topics
1	September 17 – 21	Review of calculus Round-off Errors and Computer Arithmetic
2	September 24 – 28	Algorithms and Convergence The Bisection Method
3	October 01 – 05	Fixed Point Iterations Newton' s Method and Secant Method
4	October 08 – 12	Error Analytic for Iteration Methods Accelerating Convergence
5	October 15 – 19	Zero of Polynomials and Muller's method
6	October 22 – 26	Interpolation and Lagrange Polynomials Data Approximations
7	Oct. 29 – Nov. 02	Divided Differences Hermite Interpolation
		Major Exam 1, Wednesday Nov- 1st
8	November 05 – 09	Spline Interpolation
9	November 12 – 16	Numerical differentiation Richardson's Extrapolation
10	November 19 – 23	Elements of Numerical Integration Composite Numerical Integration
11	November 26 – 30	Elementary Theory of Initial Value Problems Euler 's Method
12	December 03 – 07	Taylor's Methods Runge Kutta Methods and Error Control
13	December 10 – 14	Multistep Methods and Stability Norm of vector and matrices
		Major Exam 2, Wednesday Dec-13th
14	December 17 – 21	Eigenvalues and eigenvectors
15	December 24 – 28	Jacobi and Gauss-Seidel Iterative techniques