



Teaching Plan
FAKULTI KEJURUTERAAN ELEKTRIK
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

NUMERICAL METHODS

BACS 2222

SEMESTER 2

SESI 2008/2009

BACS 2222 NUMERICAL METHODS (2, 2, 1)

1.0 Learning Outcomes

After completing this subject, the students will be able to

1. Solve the mathematical problems using suitable numerical methods..
2. Apply numerical methods in engineering problems which are unable or difficult to solve using analytical methods.
3. Write the computational command using Matlab software in solving numerical problems.

2.0 Synopsis

This subject consists of 11 chapters: Computer Representation of Numbers, Error, Solution of Nonlinear Equations, Solution of Linear Systems, Eigen Values and Eigen Vectors, Interpolation, Curve Fitting, Numerical Differentiation, Numerical Integration, Solution of Ordinary Differential Equations, Solution of Partial Differential Equations

3.0 Practical Application

MATLAB is used as a tool to obtain better accuracy for related problems.

4.0 References

- [1] Khoo C.F., Sharifah Sakinah, S.A. and Zuraini, O. (2008). *Numerical Methods*, 2nd edition, Petaling Jaya: Pearson Prentice Hall.
- [2] Chapra S.C. (2008). *Applied Numerical Methods with Matlab for Engineers and Scientists*, 2nd edition, New York: McGraw-Hill
- [3] Chapra S.C. and Canale R.P (2006). *Numerical Methods for Engineers with Programming and Software Applications*, 5th edition, New York: McGraw-Hill.
- [4] .Abdelwahab Kharab and Ronald B.G. (2006). *An Introduction to Numerical Methods: A Matlab Approach*, Boca Raton: Chapman and Hall/CRC.
- [5] Faires J.D. and Burden R. (2003). *Numerical Methods*, 3rd edition, USA: Thomson Brooks/Cole.

5.0 Course Implementations

- i) Lecture
 - 2 hours per week for 10 weeks (Total = 20 hours)
 - 1 hours per week for one week (Total = 1 hour)
- ii) Tutorial
 - 1 hour per week for 9 weeks (Total = 9 hours)
 - 2 hours per week for 1 week (Total = 2 hours)
- iii) Laboratory Activities
 - 3 hours per semester (Total = 3 hours)
- iv) Assessment

6.0 Course Evaluations

Quizzes (3 x 5%)	15%
Mid-term test	25%
Lab work / Tutorial	5%
Assignment	15%
Final examination	40%
Total	100%

7.0 Method Of Assessment

Component	Knowledge	Competency	Attitude	Communication
Tests/Quizzes	√	√		
Assignments	√	√		√
Labs	√	√	√	√

8.0 Detail Syllabus and Teaching Plan

Week	Session	Contents	Remarks
1	Lecture 1 (2 hours)	CHAPTER I : Computer Representation of Numbers <ul style="list-style-type: none"> ▪ Decimal system ▪ Binary system ▪ Hexadecimal system ▪ Floating-point numbers CHAPTER II : Error <ul style="list-style-type: none"> ▪ Round-off error ▪ Truncation error 	28/12/09-3/1/10
2	Lecture 2 (2 hours)	CHAPTER III : Solution of Nonlinear Equations <ul style="list-style-type: none"> ▪ Bisection method ▪ Simple Fixed-point iteration ▪ Newton-Raphson method 	4/1/10-10/1/10
	Tutorial 1 (1 hour)	TUTORIAL 1 <ul style="list-style-type: none"> ▪ Topic related to lecture 1 	

3	Lecture 3 (2 hours)	CHAPTER IV : Solution of Linear Systems <ul style="list-style-type: none"> ▪ Gauss elimination ▪ Gauss elimination with partial pivoting ▪ LU decomposition 	11/1/10-17/1/10
	Tutorial 2 (1 hour)	TUTORIAL 2 <ul style="list-style-type: none"> ▪ Topic related to lecture 2 	
4	Lecture 4 (2 hours)	CHAPTER IV : Solution of Linear Systems <ul style="list-style-type: none"> ▪ Gauss-Seidel Method CHAPTER V : Eigen Values and Eigen Vectors <ul style="list-style-type: none"> ▪ Homogeneous systems: the eigen value problem ▪ Power method 	18/1/10-24/1/10 Quiz 1 (5%) Scope : Chapters I – III
	Tutorial 3 (1 hour)	TUTORIAL 3 <ul style="list-style-type: none"> ▪ Topic related to lecture 3 	
5	Lecture 5 (2 hours)	CHAPTER VI : Interpolation <ul style="list-style-type: none"> ▪ Linear interpolation ▪ Quadratic interpolation ▪ Newton's interpolating polynomials ▪ Lagrange interpolating polynomials 	25/1/10-31/1/10 Distribute Assignment Questions Scope: Chapter I - IX
	Tutorial 4 (1 hours)	TUTORIAL 4 <ul style="list-style-type: none"> ▪ Topic related to lecture 4 	
6	Lab 1 (1 hour)	LAB 1 <ul style="list-style-type: none"> • Introduction to MATLAB, • Topic related to Chapter III – VI 	1/2/10-7/2/10 Quiz 2 (5%) Scope: Chapter IV – V
7 25/8/08	Lecture 6 (2 hours)	CHAPTER VII : Curve Fitting <ul style="list-style-type: none"> ▪ Linear regression ▪ Polynomials regression ▪ Multiple linear regression 	8/2/10-14/2/09
	Tutorial 5 (1 hour)	TUTORIAL 5 <ul style="list-style-type: none"> ▪ Topic related to lecture 5 	
8		1 st Semester Break	Chinese New Year 14 & 15/2/10 15/2/10-21/2/10
9	Lecture 7 (2 hours)	CHAPTER VIII : Numerical Differentiation <ul style="list-style-type: none"> ▪ Forward, backward, central differencing of first derivative ▪ Forward, backward, central differencing of second derivative 	22/2/10-28/2/10
	Tutorial 6 (1 hour)	TUTORIAL 6 <ul style="list-style-type: none"> ▪ Topic related to lecture 6 	

10	Lecture 8 (2 hours)	CHAPTER IX : Numerical Integration <ul style="list-style-type: none"> ▪ Trapezoidal rule ▪ Simpson's $\frac{1}{3}$ rules ▪ Simpson's $\frac{3}{8}$ rules 	<i>1/3/10-7/3/10</i> Mid-term Test (25%) Scope: Chapter I – VII
	Tutorial 7 (1 hour)	TUTORIAL 7 <ul style="list-style-type: none"> ▪ Topic related to lecture 7 	
11	Lecture 9 (2 hours)	CHAPTER X : Solution of Ordinary Differential Equations <ul style="list-style-type: none"> ▪ Euler's method ▪ Heun's method ▪ Ralston's second order Runge-Kutta method 	<i>8/3/10-14/3/10</i> Submit Assignment (15%)
	Tutorial 8 (1 hour)	TUTORIAL 8 <ul style="list-style-type: none"> ▪ Topic related to lecture 8 	
12 22/9/08	Lab 2 (1 hour)	LAB 2 <ul style="list-style-type: none"> • Topic related to Chapter VII - IX 	<i>15/3/10-21/3/10</i>
13	Lecture 10 (2 hours)	CHAPTER X : Solution of Ordinary Differential Equations <ul style="list-style-type: none"> ▪ Classical fourth-order Runge-Kutta method CHAPTER XI : Solution of Partial Differential Equations <ul style="list-style-type: none"> ▪ Elliptic equations ▪ Parabolic equations 	<i>22/3/10-28/3/10</i>
	Tutorial 9 (1 hour)	TUTORIAL 9 <ul style="list-style-type: none"> ▪ Topic related to lecture 9 	
14	Lecture 11 (1 hour)	CHAPTER XI : Solution of Partial Differential Equations <ul style="list-style-type: none"> ▪ Hyperbolic equations 	<i>29/3/10-4/4/10</i> Quiz 3 (5%) Scope : Chapter VIII – IX
	Tutorial 10 (1 hour)	TUTORIAL 10 <ul style="list-style-type: none"> ▪ Topic related to lecture 10 	
15	Tutorial 11 (1 hour)	TUTORIAL 11 <ul style="list-style-type: none"> ▪ Topic related to lecture 11 	<i>5/4/10-11/4/10</i>
	Lab 3 (1 hour)	LAB 3 <ul style="list-style-type: none"> ▪ Topic related to Chapter X & XI 	
16&17 &18		FINAL EXAMINATION	<i>12/4/10 – 9/5/10</i>