Academic Course Description

BHARATH University
Faculty of Science and Humanities
Department of Mathematics

BMA402 NUMERICAL METHODS

Fourth Semester, 2016-17 (Even Semester)

Course (catalog) description

From Unit I ultimatey results in finding the numerical solutions for eigen values and eigen vectors for square matrices.

In Unit II ,we interpolate the unknown arguments between any given values ,in engineering applications this is called as smoothing functions.

Unit III states polynomial approximation is quite accurate when we use numerical methods. Various numerical integration formula gives different approximation to this area.

In unit IV many problems in science and engineering can be reduced to the problem of solving differential equation satisfying certain conditions.

In unit V we obtain a unique solution of ODE and PDE'S subject to the certain specific conditions.

Compulsory/Elective course: Compulsory for all branches except IBT,GEN.
Credit/ Contact hours : 4 credits / 75 Hours
Course Coordinator : Subhashini

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
Subhashini		CB BLOCK		**Suba.thulam@gmail.com**	12.30-1.00 pm

Relationship to other courses:

Pre –requisites **:** Branch of mathematics

Assumed knowledge : The students will have a mathematics background obtained at a high school (or Equivalent) level. In particular, working knowledge of basic mathematics which interpolate and extrapolate the values. It help us to find the numerical values for integration , differention , ODE , PDE when initial boundary conditions are given.

Following courses : NUMERICAL METHODS

Syllabus Content

UNIT I SOLUTIONS OF EQUATIONS AND EIGEN VALUE PROBLEMS 9+6

Iterative method Newton - Raphson method for single variable. Solutions of Linear system by Gaussian Gauss – Jordan, Jacobi and Gauss – Seidel methods, Inverse of a matrix by Gauss – Jordan method. Eigen value of a matrix by power and Jacobi methods.

UNITII INTERPOLATION (FINITE DIFFERENCES) 9+6

Newton's Divided Difference Formula – Lagrange's Interpolation Newton forward and backward difference formulae – Stirling's Bessel's central difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+6

Numerical Differentiation with interpolation polynomials, Numerical integration by Trapezoidal Simpson's (Both 1/3" and 3/8") rules. Double Integrals using Trapezodial and Simpson's rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS **9+6**

Single step methods – Taylors series, Euler's and Modified Euler, Runge – Kutta method of first and second order differential equations. Multiple step methods – Milne and Adam's – Bashforth predict and Corrected Method.

UNIT V BOUNDARY VALUE PROBLEMS FOR ODE AND PDE **9+6**

Finite difference for the second order ordinary differential equations. Finite difference solutions for one dimensional heat Equations. Finite difference solutions for one dimensional heat Equations(both implicit and Explicit) one dimensional wave equation and two dimensional Laplace and Poisson Equation.

Computer usage: Nil

Professional component

General	-	0%
Basic Sciences	-	100%
Engineering sciences & Technical arts	-	0%
Professional subject	-	0%

Broad area : Eigen values, Interpolation, Numerical integration and Differentiation, Initial value problems for ODE, Boundary value problems for ODE and PDE.

Test Schedule

S. No.	Test	Tentative Date	Portions	Duration
1	Cycle Test-1	February 1st week	Session 1 to 14	2 Periods
2	Cycle Test-2	March 2nd week	Session 15 to 28	2 Periods
3	Model Test	April 2nd week	Session 1 to 45	3 Hrs
5	University Examination	TBA	All sessions / Units	3 Hrs.

Mapping of Instructional Objectives with Program Outcome

To develop problem solving skills and understanding of Mathematics. This course emphasizes:	Correlates to program outcome		
	H	M	L
1. To develop an understanding of the fundamentals in finding the solutions of the equation and to find the eigen vaue of the matrix	b,c,d,j	a,f,k	e,g
2. To develop the ability to solve problems in Interpolation	b,c,f	a,d,g,h	j
3. To understand the concepts of Numerical Differentiation and Integration	a,d,e	b,g	j,k
4. To develop students problem solving techniques for Initial value problems for ODE	a,d,e	b,g,h,k	f,j
5. To learn the uses of Boundary value problems for ODE and PDE	a	a,b,c,d,g	j,k

H: high correlation, M: medium correlation, L: low correlatio

Draft Lecture Schedule

Session	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I SOLUTION OF EQUATION AND EIGEN VALUE PROBLEMS			
1.	ITERATION METHOD -INTRODUCTION	Yes	[T1]
2.	NEWTON RAPHSON METHOD FOR SINGLE VARIABLE	Yes	
3.	PROBLEMS	Yes	
4.	SOLUTION OF LINEAR SYSTEM BY GEM	Yes	
5.	GAUSS JORDAN METHOD	Yes	
6.	GAUSS JACOBI METHOD	Yes	
7.	GUASS SIEDEL METHOD	Yes	
8.	PROBLEMS	Yes	
9.	INVERSE OF THE MATRIX BY GJM	Yes	
10.	EIGEN VALUE OF MATRIX BY POWER METHOD	Yes	
11.	EIGEN VALUE OF MATRIX BY GACOBI METHOD	Yes	
12.	PROBLEMS	Yes	
UNIT II INTERPOLATION(FINITE DIFFERENCE)			
13.	FINITE DIFFERENCE-FORWARD TABLE	Yes	[T2]
14.	FINITE DIFFERENCE-BACKWARD TABLE	Yes	
15.	PROBLEMS	Yes	
16.	NEWTONS FORWARD INTERPOLATION FORMULA	Yes	
17.	NEWTON BACKWARD INTERPOLATION FORMULA	Yes	
18.	NEWTON'S DIVIDED DIFFERENCE FORMULA	Yes	
19.	PROBLEMS	Yes	
20.	LAGRANGES INTERPOLATION FORMULA	Yes	
21.	INVERSE INTERPOLATION	Yes	
22.	STIRLINGS FORMULA	Yes	
23.	BESSELS FORMULAA	Yes	
24.	PROBLEMS	Yes	
UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION			
25.	NEWTONS FORWARD DIFFERENCE FORMULA TO GET THE DERIVATIVES	Yes	[T3]
26.	NEWTONS BACKWARD DIFFERENCE FORMULA TO GET THE DERIVATIVESW	Yes	
27.	TO FIND THE MAXIMA AND MINIMA OF A FUNCTION GIVEN THE TABULAR VALUES	Yes	
28.	PROBLEMS	Yes	
29.	NUMERICAL INTEGRATION	Yes	
30.	TRAPEZOIDAL RULE	Yes	

31.	SIMPSONS ONE THIRD AND THREE EIGTH RULE	Yes	
32.	PROBLEMS	yes	
33.	ROMBERGS METHOD	Yes	
34.	TRAPEZOIDAL RULE FOR DOUBLE INTEGRATION	Yes	
35.	SIMPSONS RULE FOR DOUBLEINTEGRATION	Yes	
36.	PROBLEMS	Yes	
	UNIT IV INTIAL VALUE PROBLEMS FOR ODE		
37.	SOLUTIONS BY TAYLORS SERIES	Yes	[T4]
38.	TAYLORS SERIES-HIGHER ORDER DIFFERENTIAL EQUATIONS	Yes	
39.	EULERS AND MODIFIED EULERS METHOD	Yes	
40.	PROBLEMS	Yes	
41.	**I AND II ORDER DIFFERENTIAL EQUATIONS**	Yes	
42.	**RUNGE KUTTA METHOD**	Yes	
43.	RUNGE KUTTA METHOD-HIGHER ORDER DE	Yes	
44.	PROBLEMS	Yes	
45.	RK METHOD FOR SIMULTANEOUS FIRSR ORDER EQUATION	Yes	
46.	MILENS PREDICTOR AND CORRECTOR METHOD	Yes	
47.	ADAMS BASHFORTH PREDICTOR AND CORRECTOR FORMULA	Yes	
48.	PROBLEMS	Yes	
	UNIT V BOUNDARY VALUE PROBLEM FOR ODE AND PDE		
49.	CLASSIFICATION OF PDE OF SECOND ORDER	Yes	[T5]
50.	DIFFERENCE QUOTIENTS FORMULA	Yes	
51.	SOLUTION OF LAPALCE EQUATION	Yes	
52.	LIEBMANNS ITERATION PROCESS	Yes	
53.	PROBLEMS	Yes	
54.	DIAGONAL FIVE POINT FORMULA	Yes	
55.	STANDARD FIVE POINT FORMULA	Yes	
56.	PROBLEMS	Yes	
57.	BENDER SCHMIDT METHOD	Yes	
58.	CRANK NICHOLSON METHOD	Yes	
59.	HYPERBOLIC EQUATION	Yes	
60.	PROBLEMS	Yes	

Teaching Strategies

The teaching in this course aims at establishing a good fundamental understanding of the areas covered using:

- Formal face-to-face lectures
- Tutorials, which allow for exercises in problem solving and allow time for students to resolve problems in understanding of lecture material.
- Small periodic quizzes, to enable you to assess your understanding of the concepts.

Evaluation Strategies

Cycle Test – I	-	5%
Cycle Test – II	-	5%
Model Test	-	5%
Assignment	-	5%
Attendance	-	10%
Final exam	-	70%

Prepared by: G.SUBASHINI , Assistant professor , Department of Mathematics **Dated :**

Addendum

ABET Outcomes expected of graduates of B.Tech / Civil/ program by the time that they graduate:

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Program Educational Objectives

PEO1: PREPARATION

Civil Engineering graduates will have knowledge to apply the fundamental principles for a successful profession and/or for higher education in Civil Engineering based on mathematical, scientific and engineering principles, to solve realistic and field problems that arise in engineering and non engineering sectors

PEO2: CORE COMPETENCE

Civil Engineering graduates will adapt to the modern engineering tools and construction methods for planning, design, execution and maintenance of works with sustainable development in their profession.

PEO3: PROFESSIONALISM

Civil Engineering Graduates will exhibit professionalism, ethical attitude, communication and managerial skills, successful team work in various private and government organizations both at the national and international level in their profession and adapt to current trends with lifelong learning.

PEO4: SKILL

Civil Engineering graduates will be trained for developing soft skills such as proficiency in many languages, technical communication, verbal, logical, analytical, comprehension, team building, inter personal relationship, group discussion and leadership skill to become a better professional.

PEO5: ETHICS

Civil Engineering graduates will be installed with ethical feeling, encouraged to make decisions that are safe and environmentally-responsible and also innovative for societal improvement.

Course Teacher	Signature
G.Subashini	

Course Coordinator **HOD/Civil**