Academic Course Description

BHARATH UNIVERSITY
Faculty of Engineering and Technology
Department of Mechanical Engineering

BGE011 COMPUTATIONAL FLUD DYNAMICS
Eight Semester 2015 – 2016 – Even Semester

Course (catalog) description

To understand the concept of basic engineering mechanism

Compulsory/Elective course :

Credit & contact hours : 3&45

Course Coordinator : Mr.G.ANBAZHAGAN

Instructors :

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
Mr.G.ANBAZHAGAN	**Final Year Mech**	**JR002**		anbazhagan@bharathuniv.ac.in	

Relationship to other courses:

Pre –requisites :FMM

Assumed knowledge : By understanding about various heat exchanger design terms, it will be helpful for the student to maintain quality in his/her organization

Following courses :

Syllabus Contents

UNIT I GOVERNING DIFFERENTIAL EQUATIONS 9

Conservation of chemical species-The energy equation-Momentum equation-time averaged equations for turbulent flow-Turbulence-Kinetic energy equation-The general differential equation-Nature of coordination-Independent variable-Choice of co-ordinates-one way and two way coordinates

UNIT II DISCRETIZATION METHODS 9

Nature of numerical methods-Methods of deriving of discretization equations-Taylor series formulationVariational formulation-Methods of weighted residuals-Control volume formulation

UNIT III HEAT CONDUCTION, CONVECTION AND DIFFUSION 9

Steady One Dimensional Conduction- Two and three dimensional conduction-Steady one dimensional convection and diffusion-Discretization equations for two dimensional convection and diffusion

UNIT IV CALCULATION OF FLOW FIELD 9

Representation of pressure-gradient and continuity equation-stagged grid-momentum equations-pressure and velocity correction-pressure correction equation.Introduction to Finite Element Method-solution of steady heat conduction by FEM-incompressible flow-simulation by FEM.

UNIT V TURBULENCE AND ALGEBRAIC MODELS 9

One, two equation model-high and low Reynolds number models-Reynolds stress models-Prediction of fluid and heat transfer using standard codes.

Total : 45

Computer usage:

Professional component

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

Broad area : Fluid dynamics

Test Schedule

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

Mapping of Instructional Objectives with Program Outcome

	Correlates to program outcome		
	H	**M**	**L**
1. Will acquire knowledge of numerical techniques to the solution of fluid dynamics and heat transfer problems.	a		
2. Will get introduced to Governing Equations of viscous fluid flows	c. i		e.k.
3. Students will be enabled to understand the various discretization methods, solution procedures and turbulence modeling.	a	f	
4. To learn about calculation of flow field	c	g	e,l.
5. To study about TURBULENCE AND ALGEBRAIC MODELS	I		
6. To study of heat conduction of FEA	a	e,l.	

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

Draft Lecture Schedule.

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
1.	Conservation of chemical species	NO	GOVERNING DIFFERENTIAL EQUATIONS
2.	The energy equation	NO	
3.	Momentum equation-time averaged equations for turbulent flow-	NO	
4.	Turbulence-Kinetic energy equation	NO	
5.	The general differential equation	NO	
6.	Nature of coordination	NO	
7.	Independent variable	NO	
8.	Choice of co-ordinates	NO	
9.	one way and two way coordinates	NO	

10.	Nature of numerical methods	NO	DISCRETIZATION METHODS
11.	Methods of deriving of discretization equations	NO	
12.	Taylor series formulation Variation formulation	NO	
13.	Methods of weighted residuals	NO	
14.	Control volume formulation	NO	
15.	TUTORIAL	YES	
16.	TUTORIAL	YES	
17.	TUTORIAL	YES	
18.	TUTORIAL	YES	
19.	Steady One Dimensional Conduction- -	NO	HEAT CONDUCTION, CONVECTION AND DIFFUSION
20.	Two and three dimensional conduction-	NO	
21.	Steady one dimensional convection and diffusion	NO	
22.	Discretization equations for two dimensional convection and diffusion	NO	
23.	TUTORIAL	YES	
24.	TUTORIAL	YES	
25.	TUTORIAL	YES	
26.	TUTORIAL	YES	
27.	TUTORIAL	YES	
28.	Representation of pressure-gradient. -	NO	CALCULATION OF FLOW FIELD
29.	continuity equation	NO	
30.	stagged grid-momentum equations-	NO	
31.	pressure and velocity correction	NO	
32.	pressure correction equation	NO	
33.	Introduction to Finite Element Method-	NO	
34.	solution of steady heat conduction by FEM	NO	
35.	incompressible flow-simulation by FEM.	NO	
36.	TUTORIAL	YES	
37.	One equation model-high and low Reynolds number models	NO	TURBULENCE AND ALGEBRAIC MODELS
38.	two equation model-high and low Reynolds number models	NO	
39.	Reynolds stress models	NO	

40.	Prediction of fluid and heat transfer using standard codes	NO	
41.	TUTORIAL	YES	
42.	TUTORIAL	YES	
43.	TUTORIAL	YES	
44.	TUTORIAL	YES	
45.	TUTORIAL	YES	

Draft Lecture Schedule

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.
- Laboratory sessions, which support the formal lecture material and also provide the student with practical construction, measurement and debugging skills.
- 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	-	10%
Assignment / Seminar / Online Test / Quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by Mr.G.ANBAZHAGAN

Addendum

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

a) The ability to apply knowledge of mathematics, science, and engineering fundamentals.

b) The ability to identify, formulate and solve engineering problems.

c) The ability to design a system, component, or process to meet the desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.

d) The ability to design and conduct experiments, as well as to analyze and interpret data

e) The ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

f) The ability to apply reasoning informed by the knowledge of contemporary issues.

g) The ability to broaden the education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.

h) The ability to understand professional and ethical responsibility and apply them in engineering practices.

i) The ability to function on multidisciplinary teams.

j) The ability to communicate effectively with the engineering community and with society at large.

k) The ability in understanding of the engineering and management principles and apply them in project and finance management as a leader and a member in a team.

l) The ability to recognize the need for, and an ability to engage in life-long learning.

Program Educational Objectives

PEO1: PREPARATION:
Mechanical Engineering graduatesare enthusiastic to provide strong foundation in mathematical, scientific and engineering fundamentals necessary to analyze, formulate and solve engineering problems in the field of Mechanical Engineering.

PEO2: CORE COMPETENCE:
Mechanical Engineering graduates have competence to enhance the skills and experience in defining problems in the field of Mechanical Engineering and Technology design and implement, analyzing the experimental evaluations, and finally making appropriate decisions.

PEO3: PROFESSIONALISM:
Mechanical Engineering graduates made competence to enhance their skills and embrace new thrust areas through self-directed professional development and post-graduate training or education.

PEO4: PROFICIENCY:
Mechanical Engineering graduates became skilled to afford training 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:
Mechanical Engineering graduates are morally merged to apply the ethical and social aspects of modern Engineering and Technology innovations to the design, development, and usage of new products, machines, gadgets, devices, etc.

Course Teacher	Signature
Mr.G.ANBAZHAGAN	

Course Coordinator **HOD/MECH**

Mr.G.ANBAZHAGAN