Academic Course Description

> ## BHARATH UNIVERSITY
> ## Faculty of Engineering and Technology
> ## Department of Civil Engineering
>
> BCE 702 - COMPUTER AIDED DESIGN OF STRUCTURES
> SEVENTH Semester, 2017-18 (Odd Semester)

Course (catalog) description

To introduce the students about computer graphics, structural analysis, design and optimization and expert systems, applications in analysis.

Compulsory/Elective course : Compulsory for Civil students

Credit / Contact hours : 4 credits / 60 hours

Course Coordinator : Mr.K.Sathishkumar Assistant Professor

Instructors :

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
R.CHITRA	IV YEAR A,B	Civil block			
ANITHA	IV YEAR C,D	Civil block			

Relationship to other courses:

Pre –requisites : Computer Aided Building Drawing

Assumed knowledge : Basic knowledge in Design of structures

Following courses : BEC 7L2 COMPUTER AIDED DESIGN OF STRUCTURES LAB

Syllabus Contents

UNIT I INTRODUCTION & COMPUTER GRAPHICS   10
Introduction to computer graphics - Fundamentals of CAD – Hardware and software requirements – Design process – Applications and benefits – drafting packages- use of AUTOCAD – application to layout of buildings and structures - graphic primitives – wireframe modeling and solid modeling.

UNIT II DESIGN & OPTIMIZATION   12
Design and Optimization: Optimization techniques – principles of design of steel and RCC structures - applications to simple design problems.

UNIT III INTRODUCTION TO FINITE ELEMENT ANALYSIS   14
Introduction of Finite Element Analysis: Fundamentals of finite element analysis – steps involved - boundary value problems. Galerkin's approach – variation principles – finite element matrix - assemblage solution for deflections - stresses and strains - simple problems using triangular elements.

UNIT IV ANALYSIS OF STRUCTURES BY FINITE ELEMENT METHOD   12
Analysis of Structures by FEM: Analysis of plane truss, space truss, plane frame and space frame by using FEM packages – ANSYS – STRUDL – NASTRAN – SAP 2000.

UNIT V STRUCTURAL ENGINEERING PACKAGES   12

Structural Engineering Packages: Introduction of various structural engineering packages -analysis and design of structures by using STADD.PRO, STRAP.

TEXT BOOKS:
1. Krishna Raju, "Structural Design & Drawing (Concrete & Steel)", CBS Publishers 2004.
REFERENCE:
1. Punmia, B.C., Ashok Kumar Jain, Arun Kumar Jain, "Design of steel structures", Lakshmi Publications Pvt. Ltd 2003.
2. Rajasekaran, S., Finite Element Analysis. AH Wheelers Publishing Company Ltd.,
3. Rao S.S.Optimization – Theory and Application, Wiley Eastern Ltd.
4. Auto CADD manual.

Computer usage: Auto cadd

Professional component

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

Broad area : Reniforced concrete structures

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**
CO1 Prepare wire frame modeling and solid modeling using drafting packages	a,c,d,e		
CO2 Perform structural analysis using computer packages	C,d,e		
CO3 Prepare algorithms for the analysis and design of steel and RC structures	C,d,	j	
CO4 Analysis simple structures using expert systems	C,d,e		g
CO5 Analysis and design of structures by using STADD.PRO, STRAP	C,d,e		

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I INTRODUCTION & COMPUTER GRAPHICS			
1.	Introduction to computer graphics	No	
2.	Fundamentals of CAD	No	
3.	Hardware and software requirements	No	
4.	Design process	No	
5.	Applications and benefits	No	
6.	drafting packages	No	[T1,R1 & R4]
7.	use of AUTOCAD	No	
8.	application to layout of buildings and structures	No	
9.	graphic primitives	No	
10.	Wireframe modeling and solid modeling.	No	
UNIT II DESIGN & OPTIMIZATION			
11	Introduction to Optimization	No	
12	Optimization techniques	No	
13	principles of design of steel structures	No	
14	Design procedure of steel structures	No	[T1,R1 &R3]
15	Problems on steel structures	Yes	
16	Optimization classification	No	
17	principles of design of RCC structures	No	
18	Design procedure of RCC structures	No	
19	Problems on RCC structures	Yes	
20	Optimization techniques Problems	Yes	
21	Applications to simple design problems.	Yes	
22	Applications to simple design problems.	yes	
UNIT III INTRODUCTION TO FINITE ELEMENT ANALYSIS			
23	Introduction of Finite Element Analysis	No	
24	Fundamentals of finite element analysis	No	
25	steps involved in finite element analysis	No	
26	boundary value problems	Yes	
27	Galerkin's approach	No	
28	variation principles	No	
29	Problems using Galerkin's approach	Yes	
30	finite element matrix	No	[T1,R2]
31	assemblage solution for deflections	No	
32	stresses and strains	No	
33	Formation of finite element matrix	No	
34	simple problems using triangular elements	Yes	
35	Problems on 2 node triangular elements	Yes	
36	Problems on 3 node triangular elements	Yes	
UNIT IV ANALYSIS OF STRUCTURES BY FINITE ELEMENT METHOD			
37	Analysis of Structures by FEM	No	
38	Analysis of plane truss using FEM packages	No	
39	Problems on plane truss	Yes	
40	Analysis of space truss using FEM packages	No	[T1,R2]
41	Problems on space truss	Yes	

42	Analysis of plane frame using FEM packages	No	
43	Problems on plane frame	Yes	
44	Analysis of space frame using FEM packages	No	
45	Problems on space frame	Yes	
46	Design principle of ANSYS	No	
47	Design principle of STRUDL – NASTRAN	No	
48	Design principle of SAP 2000.	No	
UNIT V STRUCTURAL ENGINEERING PACKAGES			
49	Structural Engineering Packages	No	
50	Introduction of various structural engineering packages.	No	
51	Design principles of STADD.PRO,	No	
52	Design principles of STRAP.	No	
53	Analysis of beams by using STADD.PRO,	yes	[T1,R2 & R4]
54	Analysis of frames by using STADD.PRO	yes	
55	Analysis of truss by using STADD.PRO	yes	
56	Analysis of beams by using STRAP	yes	
57	Analysis of frames by using STRAP	yes	
58	Analysis of truss by using STRAP	yes	
59	Introduction to auto cadd	No	
60	Detailed study about drawings	No	

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	-	5%
Assignment	-	5%
Attendance	-	10%
Final exam	-	70%

Prepared by, Mr.K.Sathishkumar Department of Civil   **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 hardware and software 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
ANITHA	
CHITRA.R	

Course Coordinator

HOD/CIVIL