Academic Course Description

BHARATH UNIVERSITY

Faculty of Engineering and Technology

Department of Mechanical Engineering

BGE010 RAPID PROTOTYPING

Eighth Semester, 2015-16 (Even Semester)

Course (catalog) description

To provide knowledge on different types of Rapid Prototyping systems and its applications in various fields.

Compulsory/Elective course : Non Major Elective

Credit & contact hours : 3 & 45

Course Coordinator : Mr.Durai Raj

Instructors **:** Dr. A. Buckshumiyan.

Name of the instructor	Class handling	Office location	Office phone	Email (domain:@ bharathuniv.ac.in	Consultation
Dr. A. Buckshumiyan.	Final Year Mech	JR002		Backshumiyana.mech@ bharathuniv.ac.in	9.00 to 9.50 am

Relationship to other courses:

Pre –requisites **:** Manufacturing Technology

Assumed knowledge : By understanding the concept of basic mechanics and manufacturing technology.

Following courses : **Nil**

Syllabus Contents

Unit I Introduction **10**

Basic operation – impact of rapid proto typing and tooling on product development - benefits-applications.

Unit II Rapid Prototyping Processes **10**

Introduction –classification-laminated object manufacturing-fused deposition modeling -stereolithography solid ground curing –selective laser sintering - 3d printing

Unit III Cad Processes **10**

Introduction –data requirements-solid modeling –surface modeling .geometric processing –interface formats-model preparation-slicing, support structures and machine instructions

Unit IV Materials for Rapid Prototyping **5**

Plastics- resins -metals-ceramics selection of materials for suitable processes – advantages-limitations

Unit V Rapid Tooling Processes **10**

Introduction - Classification in Direct rapid tooling - Silicon rubber moulding - Epoxy moulding - Electro forming - Vacuum casting - Vacuum forming - Rapid tools for injection moulding – Direct rapid cooling processes – SLS rapid tool - Shape deposition manufacturing - Laser deposition lamination - Rapid tooling roots

Total : 45 Hours

Text Book(s) and /or required materials

TEXTBOOKS:

1. **Ibrahim Zeid, CAD/CAM theory and practice, Tata Mc Graw hill, 2005**

REFERENCES :

1. **Paul F. Jacobs, Rapid Prototyping and Manufacture. Fundamentals of Stereolithography,1995**
2. **Rapid Prototyping reports, CAD/CAM publishing,1991**
3. **Rapid News, University of Warwick. UK 1995**
4. **Rapid tools for Injection Moulding (www.vmreg.com/raptia/reports/CRIF.pdf)Applications of RP techniques for sheet metal forming (www.raptia.org) Medical RP applications (http://home.att.net/-rppat /museum/mus-5.htm)**

Computer usage: **Yes.**

Professional component

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

Broad area: Manufacturing

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. Generating a good understanding of RP history, its development and applications. Expose the students to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering	a		
2. Students will be exposed to different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.	a,c,i,l	d	
3. Students will understand steriolithography methods	c,l	f	
4. Students learn processes of CAD	a,c	h	k,l
5. Students gain knowledge to develop prototypes	a		l
6. Students learn the concepts of rapid tool processing			

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

Draft Lecture Schedule

S.NO	Topics	Problem solving (Yes/No)	Text / Chapter
UNIT I Introduction			
1.	Introduction of Rapid Prototyping	No	[T1] chapter -1,2, [R1]
2.	Basic operation	No	
3.	Impact of RP	No	
4.	Rapid Tooling	No	
5.	Product Development	No	
6.	Methods of Developments	No	
7.	Classification of rapid processes	No	
8.	Various materials	No	
9.	Benefits of RP	No	
10.	Application	No	
UNIT II Rapid Prototyping Processes			
11.	Rapid Prototyping Processes	No	[T1] chapter - 3, [R1, R3]
12.	Classification	No	
13.	Laminated object manufacturing	No	
14.	Advantages and disadvantages	No	
15.	Fused deposition modeling	No	
16.	Stereolithography	No	
17.	Advantages and disadvantages of stereolithography	No	
18.	Solid ground curing	No	
19.	Selective laser sintering	No	
20.	3D Printing	No	
UNIT III CAD Processes			
21.	Introduction of CAD Processes	No	[T1] chapter - 5, [R2]
22.	Data Requirements	No	
23.	Solid modeling	No	
24.	Surface modeling	No	
25.	Geometric processing	No	
26.	Interface formats	No	
27.	Model preparation	No	
28.	Slicing structures	No	
29.	Machine Instructions	No	
30.	Preparation of CAD	No	
UNIT IV Material for Rapid Prototyping			
31.	Types of Materials	No	[T1] chapter - 6, [R2,R3]
32.	Plastic Materials	No	
33.	Resin	No	
34.	Ceramics materials	No	
35.	Advantages and limitations	No	
UNIT V Rapid Tooling Processes			
36.	Rapid Tooling Processes	No	[T1] chapter – 7,8, [R4]
37.	Classification in direct rapid tooling	No	

38.	Silicon rubber moulding	No	
39.	Epoxy moulding	No	
40.	Electro forming	No	
41.	Vacuum forming	No	
42.	Rapid tools for injection Moulding	No	
43.	Direct rapid cooling processes	No	
44.	SLS Rapid tool, Shape deposition manufacturing	No	
45.	Laser deposition lamination, Rapid tooling roots.	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	-	10%
Assignment / Seminar / Online Test / Quiz	-	5%
Attendance	-	5%
Final exam	-	70%

Prepared by Dr. A. Buckshumiyan

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 graduates are 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
Dr. A. Buckshumiyan	

Course Coordinator **HOD/MECH**
Mr.Durai Raj