A Project Report

on

Thermo-Structural Design & Analysis of Control Surface TPS for Hypersonic Missile

Submitted in partial fulfilment of the requirements for the award of the degree

BACHELOR OF TECHNOLOGY

IN

MECHANICAL ENGINEERING

by

Mohammed Abdullah Ghori (17RT1A0332)

Under the guidance of

Mr S. Narendar

(Scientist-D, TSTF, DSMT, Defense Research & Development Organization)

Dr S. M. Hussaini

(HoD, Mechanical Engineering, NSAKCET)

Department of Mechanical Engineering

NAWAB SHAH ALAM KHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

Approved by AICTE, Affiliated to JNTUH, Malakpet, Hyderabad

Year of submission: 2021

CERTIFICATE

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Mohammed Abdullah Ghori **17RT1A0332**

In partial fulfillment for the award of the Degree of Bachelor of Technology in Mechanical Engineering to the Jawaharlal Nehru Technological University, Hyderabad is a record of bonafide work carried out under my guidance and supervision at Nawab Shah Alam Khan College of Engineering and Technology.

The results embodied in this project report have not been submitted to any other University or Institute for the award of any Degree or Diploma.

Dr Syed Mujahed Hussaini
Project Guide & Head of the Department

Dr Syed Abdul Sattar
Principal

PRINCIPAL
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Signature with date:

Note: Exam was conducted online
Proof of supervisor -

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सत्यमेव जयते

Letter No. DRDL/DHRTM/HRD/PROJECT/2021/ **Date: 10th June 2021**

CERTIFICATE

This is to certify that **Sri Mohammed Abdullah Ghori** student of **B.Tech. Mechanical** (Roll No. 17RT1A0332) of **Nawab Shah Alam Khan College of Engineering & Technology**, Dept. of Mechanical Engineering, Hyderabad has undergone the Internship from **1st January 2021** to **31st March 2021** at Defence Research & Development Laboratory (DRDL), Kanchanbagh, Hyderabad. He has successfully completed the Internship under the guidance of **Shri. S. Narendar, Scientist 'D'**, STF/DSMT, DRDL. His Project title was "**Thermo-Structural Design and Analysis of Control Surface TPS for a Hypersonic Missile**".

During his internship period, he was found to be sincere & hard working. He also took keen interest in the learning about Hypersonic Flows and CFD.

(Shri S. Narendar)
Scientist-D
STF/DSMT
DRDL

(Dr. K. NAGESHWARA RAO)
Scienitst-G
Director, HRTM
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Dr. K. NAGESWARA RAO
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ACKNOWLEDGEMENT

The project work for this dissertation was carried out at *Defence Research & Development Organisation* during the period 2020-2021. This dissertation has been a part of the Major Project submitted to *Jawaharlal Nehru Technological University, Hyderabad* in partial fulfilment of the requirements for the award of degree *"Bachelor of Technology in Mechanical Engineering"*.

It is with sincere appreciation and thanks to those outstanding individuals who truly made this work possible are duly acknowledged. I am greatly indebted to my project supervisor *Mr S. Narendar* (Scientist-D, TSTF, DSMT, DRDO) for his months of patience, efforts and invaluable guidance as a mentor & advisor. Without his keen insight and depth of engineering expertise, the accomplishment of this study would have been significantly impaired. I also wish to thank my internal project supervisor, *Professor S. M. Hussaini* (HoD, Department of Mechanical Engineering, NSAKCET) for his exceptional guidance & ingenuity that has added greatly to the success of this project. I am proud to consider *Mr S. Narendar* and *Professor S. M. Hussaini* a professional mentor and an inspiration.

I would like to express my gratitude towards *Mr Syed Saadullah Hussaini* (Scientist-E, DLRL) for his efforts in helping me get this incredible opportunity of interning at DRDO.

I would like to thank the project coordinator, *Mr Aqeel Ahmed* for his guidance. Additionally, I am also grateful to our principal, *Dr Syed Abdul Sattar* and the management of *Nawab Shah Alam Khan College of Engineering and Technology* under whose supervision the institution runs most successfully.

I am extremely thankful to my parents, brothers and sister for their enormous love & support throughout this endeavour.

Lastly, I would also like to acknowledge all the staff members and friends who have taken time out to help me make this project a whopping success.

ABSTRACT

On 24 July 1969, *Apollo 11* successfully re-entered the Earth's atmosphere, returning from a historic manned mission to the moon. During the re-entry, the vehicle's Mach Number was 32.5 and the velocity of the capsule exceeded 11.2 km/s. Due to such colossal entry speed, a temperature of *11,600 K* was induced at the stagnation region & boundary layer of the Apollo 11 capsule.

The development of a hypervelocity vehicle is associated with numerous technical challenges. One of the most complex issues faced by the engineers, that dominates the design of a hypersonic vehicle is *Aerodynamic Heating*, a flow consequence that is further substantial for an air-breathing hypersonic vehicle. It is therefore imperative to design a robust heat shielding system that can mitigate the deleterious effects of aerodynamic heating on the airframe & payload of the vehicle. However, the design of a thermal management system requires accurate prediction of various flow phenomena such as entropy layer, viscous interactions, chemical nonequilibrium etc. that affects the aerothermodynamics of the flow around a hypervelocity vehicle. Based on the intensity of aerodynamic heating and the design requirements, an optimal thermal management system must be designed such that they provide indispensable protection without adding excessive load to the structure of the vehicle.

This project focuses on the design & validation of a *hot structure* system for the control surface of a hypersonic missile flying at Mach 7.0. A Multiphysics simulation that involves coupled Fluid-Thermal-Structural analysis was performed in which the flow of air & the wall temperature due to aerodynamic heating was analysed. Different TPS concepts & high-temperature materials were studied to assess their performance under such intense flight conditions. Finally, a structural simulation was conducted to study the viability and performance of the multi-material wing structure.

***Key Words*: Hypersonic, Aerothermodynamics, CFD, Multiphysics, Metal Matrix Composite, Super Alloys, CMC, Chemical Nonequilibrium, Ablative Protection**

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A Project Report

On

Solar Refrigerator System Without Compressor

Submitted in partial fulfillment of the requirements for the award of degree

BACHELOR OF TECHNOLOGY

IN

MECHANICAL ENGINEERING

By

MOHMMED KHAJA	**17RT1A0378**
MD OMAIR AHMED	**17RT1A0382**
SHAIK ABDUL OBAID	**17RT1A0393**
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In partial fulfillment for the award of the Degree of Bachelor of Technology in Mechanical Engineering to the Jawaharlal Nehru Technological University, Hyderabad is a record of bonafied work carried out under my guidance and supervision at Nawab Shah Alam Khan Collage of Engineering and Technology Hyderabad .

The results embodied in this project report have not been submitted to any other University or Institute for the award of any Degree or Diploma.

28/06/21

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Name: **Signature with date**

Note - Exam was conducted online
Project supervisor - 28/06/21

ACKNOWLEDGEMENT

The research work for this thesis was carried out at the Mechanical Engineering department of Nawab Shah Alam College of Engineering and Technology during the period 2020-2021. This thesis has been a part of Major project submitted to Jawaharlal Nehru Technological University, Hyderabad in partial fulfillment of the requirements for the award of degree "Bachelor of Technology in Mechanical Engineering".

The satisfaction and euphoria that accompany the successful completion of the project would be great but incomplete without mentioning people who made it possible with their constant guidance and encouragement. In this context,

We would cordially thank to our internal guide **Dr. Noor Alam**, project coordinator Mr. Mohammed Aqeel Ahmed and head of mechanical engineering department Dr. Syed MujahedHussaini for all their technical guidance, constant encouragement and moral support in carrying out our project and making it a success.

We are also grateful to our principal, Dr. Syed Abdul Sattar and management of Nawab Shah College of Engineering and Technology under whose supervision the institution runs most successfully.

We would like to express out our heart-felt gratitude to our parents without whom we would not have been privileged to achieve and fulfill our dreams.

We would also like to express our gratitude to all the people behind the screen who helped us to transform an idea into real application.

We thank all the other staff members and our helping friends who have extended their timely help and eased our task

Development of solar refrigeration

Abstract—

The global increasing demand for refrigeration, led to production of more electricity and consequently more use of chlorofluorocarbons (CFCs) which acts as a contributing factor in the depletion of ozone layer. Thermoelectric refrigeration is new alternative because it can convert waste electricity into useful cooling. Therefore, thermoelectric refrigeration is greatly needed, particularly for developing countries where long life and low maintenance are needed. The objective of this study is to design and develop a working thermoelectric refrigerator that utilizes the Peltier effect to refrigerate and maintain a selected temperature low. The requirements are to cool this volume to temperature within a time period of 2 hours and provide retention of at least next half an hour. Our project also utilizes the solar energy to run a thermoelectric system. In this project we have fabricated a thermoelectric system using both solar power and electrical power supply. The project has various applications like, food preservation, military or aerospace, medical and pharmaceutical equipment.

Index Terms— Peltier effect, Module, Thermoelectric, Solar powered, Heat flow, Coefficient of Performance

Table of content

A Project Report

On

DESIGN AND FABRICATION OF SOLAR POWERED E BICYCLE

Submitted in partial fulfillment of the requirements for the award of degree

BACHELOR OF TECHNOLOGY

IN

MECHANICAL ENGINEERING

By

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SHAIK ASHRAF ALI	**(17RT1A0395)**
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ABSTRACT

Electric bicycles (e-bycycle) are considered a sustainable alternative to automobile transportation today. The electric bike includes all the benefits that conventional bicycles offer, plus faster, more comfortable and longer trips, as well as less effort for the user. In this paper, we specifically focus on a new type of e-bike, the so-called 'solar-powered e-bike'. Therefore, this review paper explores existing literature findings for the use of solar energy in transportation, and more specifically in e-bycycle. This paper aims to capture the status of and experiences with the use of e-bycycle; more specifically, with solar-powered e-bycycle. It presents research conducted so far on e-bycycle and solar-powered e-bycycle, as well as the main technical features of the solar e-bike. Finally, it analyzes a sample of e-bycycle' and solar-powered e-bycycle' users, based on Dutch National Travel Survey data and an experimental field study conducted in 2017.

Data showed that the main target group of (solar) e-bycycle are commuters in the age group between 40 and 60 years old, commuting distances longer than 6 km, with a gross income higher than €2500. Solar-powered e-bycycle are concluded to have potential as a sustainable way of transportation in urban areas and cities, potentially replacing the conventional means of transport.

CONTENT

A Project Report

On

Design & Analysis of Composite Car Bumper

Submitted in partial fulfillment of the requirements for the award of degree

BACHELOR OF TECHNOLOGY

IN

MECHANICAL ENGINEERING

By

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Dr. SYED MUJAHED HUSSAINI
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ABSTRACT

Bumper is one of the main parts of automobile industry which are used as protection for the vehicle from front and rear collision. The aim of this project is to analyze and study the structure & material employed for car bumper, In this study, the most important variables like material, structures, shapes and impact conditions are studied for analysis of bumper beam in order to improve the crashworthiness during collision. The simulation of the bumper is characterized by impact modelling using Ansys R18.1. In this research, the three types of materials were selected that are relevant to be applied to front bumper beam.

- The materials are expanded polypropylene (EPP), glass mat thermoplastic(GMT), and sheet molding compound (SMC).
- These materials were studied by impact modelling to determine structural, modal, and thermal analysis.
- The selected materials are compared to each other to find the best material with highest material strength and structure.
- The results showed that a modified SMC bumper can reduce the impact of collision with higher performance and was suggested to replace GMT AND EPP.
- The findings also showed that EPP cannot totally absorb the energy and reduce the impact of collision.

KEYWORDS: Bumper, collision, sheet molding compound, energy.

CONTENTS

NAWAB SHAHA ALAM KHAN COLLEGE OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF MECHANICAL ENGINEERING

4-2 A & B Sections Major Projects Review (A.Y 2020-2021) Marks Distribution Sheet

Batch No.	Hall Ticket No.	Marks Distribution						
		Abstract (15)	Review-1 (15)	Review-2	Review-3 (20) Online	Report (10)	Pre-Viva (25) Online	Total (100)
Energy Harvesting through Exersise					Guide: Mr. MD Naser			
A1.	16E01A0355	12	12	14	13	10	19	80
	16E01A0360	14	14	14	18	10	21	91
	15E01A0357	14	14	14	19	10	22	93
Power Generation in Railway Track by using Mechanical Motion.					Guide: Mr Mirza Haroon Baig			
A2.	15RT1A0337	14	14	14	19	10	23	94
	15RT1A03C2	14	13	12	18	10	21	88
	15RT1A03E3	15	14	15	14	10	16	84
	17RT1A0344	15	14	15	14	10	23	91
Design and Fabrication of 2 Wheel Drive for Industrial Fork Lift					Guide: Dr. S.M. Hussaini			
A3.	16E01A0302	14	12	14	16	09	20	85
	16E01A0329	15	10	14	19	08	21	87
	17RT1A0348	14	14	15	18	08	22	91
	17RT1A0367	15	14	14	18	09	22	92
Design of Air Conditioning System for Hospitals					Guide: Mr. Abdul Jabbar			
A4.	16E01A0361	15	14	14	18	10	23	94
	16E01A0368	15	13	13	17	10	21	89
	16RT1A0383	15	12	12	18	08	17	82
	17RT1A0329	15	14	14	18	09	23	93
Heat Load Calculation for Commercial Building using HAP.					Guide:Mr. Mohammed Taher			
A5.	16RT1A0316	15	15	14	18	10	24	96
	16RT1A0355	15	14	14	15	10	18	86
	16RT1A03A4	15	14	14	14	10	18	85
	16RT1A03B4	14	14	14	14	10	18	84

Design and Analysis of Composite Aircraft Wing					**Guide: Mr. Mohammed Aqeel Ahmed**			
A6	16RT1A0320	15	11	12	15	08	24	85
	16RT1A0321	15	11	12	15	08	24	85
	16RT1A0345			13			18	31
	17RT1A0336	15	11	12	15	08	23	84
Design and Analysis of Hellical Coiled Heat Exchanger					**Guide: Mr Mirza Haroon Baig**			
A7	17RT1A0301	15	11	12	15	08	25	86
	17RT1A0311	15	11	12	15	08	24	85
	17RT1A0330	15	11	12	15	08	24	85
Fabrication of Electric Bicyle					**Guide: Mr. Amer Ur Rahman**			
A3	17RT1A0307	15	11	12	15	08	20	81
	17RT1A0321			13			23	36
	17RT1A0326	15	11	12	15	08	23	84
	17RT1A0328	15	11	12	15	08	20	81
Hybrid Power Generation from Solar and Wind Energy.					**Guide: Mr. Shabbir Ahmed**			
A9	17RT1A0308	15	11	12	15	08	23	84
	17RT1A0334			13			23	36
	17RT1A0342	15	11	12	15	08	22	83
	17RT1A0343	15	11	12	15	08	20	81
Fabrication of Pneumatic Paper Cup Making Machine.					**Guide: Mr. Syed Shakeel Ahmed**			
A10	17RT1A0312	15	11	12	15	08	19	80
	17RT1A0327			13			21	34
	17RT1A0341	15	11	12	15	08	22	83
	17RT1A0360	15	11	12	15	08	18	79

Fabrication of Electric Scooter					**Guide: Mr. Raza Ahmed Khan**			
A11	17RT1A0319	15	11	12	15	08	25	86
	17RT1A0320			13			25	38
	17RT1A0331	15	11	12	15	08	24	85
	17RT1A0346	15	11	12	15	08	22	83
Thermo-Structural Design and Analysis of Hypersonic Cruse Missile Wing.					**Guide: Dr. S.M. Hussaini**			
A12	17RT1A0332	15	11	12	15	08	25	86
Electromagnetic Braking System					**Guide: Mr. Md Sharjeel Zeeshan**			
A13	17RT1A0333	15	11	12	15	08	23	84
	17RT1A0338			13			22	35
	17RT1A0361	15	11	12	15	08	24	85
	16RT1A0346	15	11	12	15	08	15	76
Dual Axis Solar Tracking System					**Guide: Mr. Shabbir Ahmed**			
A14	17RT1A0351	15	11	12	15	08	21	82
	17RT1A0356			13			25	38
	17RT1A0357	15	11	12	15	08	24	85
	17RT1A0362	15	11	12	15	08	23	84
Fabrication of Air Operated Vice					**Guide: Mr. Amer Ur Rahman**			
A15	17RT1A0366	15	11	12	15	08	23	84
	17RT1A0368			13			21	34
	17RT1A0370	15	11	12	15	08	21	82

A Solution for Joint Pain and Other Diseases through portable Exercise Machine					Guide:Dr. Zahir Hasan			
B1	17RT1A0374	15	11	12	15	08	23	84
	17RT1A0377			13			22	35
	17RT1A0383	15	11	12	15	08	23	84
	17RT1A0391	15	11	12	15	08	23	84
Development of Solar Refrigerator Without Compresor					Guide: Dr. Noor Alam			
B2	17RT1A0378	15	11	12	15	08	23	84
	17RT1A0382			13			24	37
	17RT1A0393	15	11	12	15	08	23	84
	17RT1A03A8	15	11	12	15	08	22	83
Design and Analysis of Composite Car Bumper					Guide: Dr. S M Hussaini			
B3	17RT1A0379	15	11	12	15	08	25	86
	17RT1A0386			13			24	37
	18RT5A0318	15	11	12	15	08	25	86
Two-Bay crack Arrest Capability Evaluation in Metallic Fuselage					Guide: Mr. Mohammed Aqeel Ahmed			
B4	17RT1A0381	12	12	12	17	8	20	82
	17RT1A03A0	13	13	13	17	9	24	89
	17RT1A03A2	13	13	13	17	9	22	86
	18RT5A0310	13	13	13	18	09	24	90

Design and Fabrication of Stair Lift						Guide: Mr. Fazal Mohammed		
B5	17RT1A0389	14	14	14	18	09	23	91
	17RT1A03A5	14	14	14	18	09	24	92
	17RT1A03A7	13	13	13	18	09	20	86
	17RT1A03B6	13	13	13	18	09	20	86
Design and Fabrication of Solar E-Bicycle						Guide:Mr. Raza Ahmed Khan		
B6	17RT1A0394	14	14	14	19	10	25	97
	17RT1A0395	15	15	15	20	10	25	99
	18RT5A0316	14	14	14	19	10	24	96
	18RT5A0326	15	15	15	19	10	24	97
Design and Enhancement of Oxygen Concentrator Machine						Guide: Mr.Mohammed Aqeel Ahmed		
B7	17RT1A03A6	12	12	12	17	08	21	83
	17RT1A03C1	12	12	12	17	08	21	83
	17RT1A03B4	13	13	13	18	09	23	90
	17RT1A03B8	14	14	14	18	09	23	91
	17RT1A03C0	13	13	13	17	09	23	88
Design and analysis of composite gear box casting						Guide: Ms. Tasleem Banu		
B8	17RT5A0306	14	14	14	18	09	23	92
	17RT5A0328	13	13	13	18	09	24	91
	17RT1A03B5	10	10	10	13	07	23	73
	18RT5A0304	13	13	13	17	09	23	87

Design and Fabrication of Solenoid Engine					**Guide: Mr. Syed Sadat Ali**			
B9	17RT5A0309	13	13	13	17	08	21	84
	17RT5A0314	12	12	12	17	08	20	82
	17RT5A0325	14	14	14	18	09	22	90
	17RT5A0326	12	12	12	17	08	21	83
Fabrication of Screw turbine for Electricity generation					**Guide: Ms. Tasleem Banu**			
B10	18D95A0311	14	14	14	19	10	25	97
	18RT5A0328	13	13	13	17	09	21	86
Design of central Air Conditioning System in College Building					**Guide: Mr. Md Rasheed**			
B11	18RT5A0315	13	13	13	17	09	22	87
	18RT5A0325	13	13	13	18	09	23	89
	18RT5A0308	13	13	13	17	08	21	84
	18RT5A0317	13	13	13	17	09	17	81
Experimental investigation on CI Engine using tyre pyrolysis oil					**Guide: Mr. Ahmad Hussain**			
B12	18RT5A0303	13	13	13	17	09	23	88
	18RT5A0314	13	13	13	17	09	24	89
	18RT5A0330	13	13	13	17	09	23	87
	18RT5A0331	13	13	13	18	09	23	90

Friction Stir Spot Weldments by using similar metals					**Guide: Dr. Zahir Hasan**			
B13	18RT5A0304	13	13	13	17	09	23	87
	18RT5A0311	13	13	13	18	09	23	89
	18RT5A0312	13	13	13	17	09	22	86
	18RT5A0302	13	13	13	18	09	24	90
Development of Solar Water Heater					**Guide: Mr. Fazal Mohammed**			
B14	18RT5A0301	14	14	14	18	09	25	93
	18RT5A0305	13	13	13	17	09	24	89
	18RT5A0309	13	13	13	18	09	25	92
	18RT5A0329	13	13	13	18	09	24	91
Heat Transfer Analysis on Rectangular plate by natural convection.					**Guide: Dr. Noor Alam**			
B15	18RT5A0313	13	13	13	17	08	21	84
	18RT5A0307	13	13	13	17	09	21	86
	18RT5A0319	14	14	14	18	09	22	91
	18RT5A0322	14	14	14	18	09	24	93
Fabrication of Four Way Motorized Hacksaw					**Guide: Mr. MD Naser**			
B16	18RT5A0323	14	14	14	18	09	23	91
	18RT5A0324	13	13	13	18	09	23	90
	18RT5A0327	13	13	13	17	09	21	85

Nawab Shah Alam Khan College of Engineering & Technology, JNTUH Hyderabad

DEPARTMENT OF MECHANICAL ENGINEERING

B.Tech IV YEAR, II SEM - Major Project ATTAINMENT CALCULATIONS - Academic Year: 2020-21

Subject: Major Project C821R Name of the Faculty: Mohammed Aqeel Ahmed

S.No.	HT No.	Internal (25 M)	External (75 M)
1	17RT1A0301	25	74
2	17RT1A0307	20	67
3	17RT1A0308	23	70
4	17RT1A0311	24	72
5	17RT1A0312	19	66
6	17RT1A0319	25	70
7	17RT1A0320	25	71
8	17RT1A0321	23	71
9	17RT1A0326	23	68
10	17RT1A0327	21	70
11	17RT1A0328	20	68
12	17RT1A0329	23	70
13	17RT1A0330	24	72
14	17RT1A0331	24	74
15	17RT1A0332	25	74
16	17RT1A0333	23	72
17	17RT1A0334	23	69
18	17RT1A0336	16	69
19	17RT1A0338	22	70
20	17RT1A0341	22	68
21	17RT1A0342	22	67
22	17RT1A0343	20	65
23	17RT1A0344	21	68
24	17RT1A0346	22	65
25	17RT1A0348	22	69
26	17RT1A0351	21	65
27	17RT1A0356	25	72
28	17RT1A0357	24	72
29	17RT1A0360	18	65
30	17RT1A0361	24	72
31	17RT1A0362	23	68
32	17RT1A0366	23	70
33	17RT1A0367	22	70
34	17RT1A0368	21	67
35	17RT1A0370	21	68
36	17RT1A0374	23	63
37	17RT1A0377	22	66
38	17RT1A0378	23	64
39	17RT1A0379	25	74
40	17RT1A0381	20	62
41	17RT1A0382	24	64
42	17RT1A0383	23	63
43	17RT1A0386	24	72
44	17RT1A0389	23	68
45	17RT1A0391	23	65
46	17RT1A0393	23	66
47	17RT1A0394	25	72
48	17RT1A0395	25	74
49	17RT1A03A0	24	65
50	17RT1A03A2	22	64
51	17RT1A03A5	24	68
52	17RT1A03A6	21	62
53	17RT1A03A7	20	66
54	17RT1A03A8	22	62
55	17RT1A03B4	23	67
56	17RT1A03B5	23	50
57	17RT1A03B6	20	66
58	17RT1A03B8	23	68
59	17RT1A03C0	23	65
60	17RT1A03C1	21	62
	AVG of 1-60	22.47	67.77

S.No.	HT No.	Internal (25 M)	External (75 M)
61	17RT5A0306	23	69
62	17RT5A0309	21	63
63	17RT5A0314	20	62
64	17RT5A0325	22	68
65	17RT5A0326	21	62
66	17RT5A0328	24	67
67	17RT5A0329	18	
68	18D95A0311	25	72
69	18RT5A0301	25	68
70	18RT5A0302	24	66
71	18RT5A0303	23	65
72	18RT5A0304	23	64
73	18RT5A0305	24	65
74	18RT5A0306	21	64
75	18RT5A0307	21	65
76	18RT5A0308	21	63
77	18RT5A0309	25	67
78	18RT5A0310	24	66
79	18RT5A0311	23	66
80	18RT5A0312	22	64
81	18RT5A0313	21	63
82	18RT5A0314	24	65
83	18RT5A0315	22	65
84	18RT5A0316	24	72
85	18RT5A0317	17	64
86	18RT5A0318	25	72
87	18RT5A0319	22	69
88	18RT5A0322	24	69
89	18RT5A0323	23	68
90	18RT5A0324	23	67
91	18RT5A0325	23	66
92	18RT5A0326	24	73
93	18RT5A0327	21	64
94	18RT5A0328	21	65
95	18RT5A0329	24	67
96	18RT5A0330	23	64
97	18RT5A0331	23	67
98			
99			
100			
101			
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119			
120			
	AVG of 61-120	22.54	66.28

S.No.	HT No.	Internal (25 M)	External (75 M)
121			
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179			
180			
	AVG of 121-180	#DIV/0!	#DIV/0!

AVERAGE	22.49	67.21
COURSE OUTCOMES	CO1,CO2, CO3,CO4	CO1,CO2, CO3,CO4
CO WISE SUM	22.49	67.21
CO Wise Percentage %	89.98	89.61

	INTERNAL MARKS %	INTERNAL ATAINMENT	EXTERNAL MARKS %	EXTERNAL ATTAINTMENT	DIRECT ATTAINMENT LEVELS
CO1	89.98	3	89.61	3	3
CO2	89.98	3	89.61	3	3
CO3	89.98	3	89.61	3	3
CO4	89.98	3	89.61	3	3
AVG	89.98	3.00	89.61	3.00	3.00

CO-PO Matrix for LABs

CO ATTAINMENT	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
CO1	3	3	3	3	1	3	3	2	3	3	2	2	3	2	2	
CO2	3	3	3	3	2	3	3	3	3	3	2	2	3	2	3	
CO3	3	3	3	3	3	3	3	2	3	3	2	2	3	2	3	
CO4	3	3	2	3	3	3	3	2	3	3	2	2	3	2	2.5	
Average	3.00	3.00	2.75	3.00	2.25	3.00	3.00	2.25	3.00	3.00	2.00	2.00	3.00	2.00	2.63	3.1.3

LAB	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	
Direct Attaintment	3.00	3.00	2.75	3.00	2.25	3.00	3.00	2.25	3.00	3.00	2.00	2.00	3.00	2.00	2.63	3.3.2
Indirect Attaintment	2.625	2.75	2.5	2.5	3	2	2.5	2	2.15	2	2.6	2.35	2.75	2.875	2.75	
Final Attaintment	2.93	2.95	2.70	2.90	2.40	2.80	2.90	2.20	2.83	2.80	2.12	2.07	2.95	2.18	2.65	