

**DESIGN AND MATERIAL OPTIMIZATION OF  
COLLING FINS IN ELECTRIC VEHICLE MOTOR  
HOUSING**

**A PROJECT REPORT**

*Submitted  
by*

|                        |                       |
|------------------------|-----------------------|
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*in partial fulfillment for the award of the degree  
of*  
**BACHELOR OF ENGINEERING**  
*in*  
**MECHANICAL ENGINEERING**



**T.J.S ENGINEERING COLLEGE**



**ANNA UNIVERSITY: CHENNAI 600 025**

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**T.J.S. ENGINEERING COLLEGE**  
Peruvoyal, Kavaraipettai,  
Gummidipoondi Taluk,  
Thiruvallur Dist - 601 206.




**JUNE 2022**

## BONAFIDE CERTIFICATE

Certified that this project report "DESIGN AND MATERIAL OPTIMIZATION OF COOLING FINS IN ELECTRIC VEHICLE MOTOR HOUSING" is the bonafide work of "P.V.ASWIN (112818114004), R.LOGESH (112818114025), G.R.SAIKUMAR (112818114039), S.VIGNESHKUMAR (112818114047)", who carried out the project work under my supervision.


  
21/6/22  
SIGNATURE

Dr. K. KAMAL BABU, Ph.D.(NIT-T)  
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Submitted for project viva - voce examination held on 22/06/2022

  
22/6/22  
INTERNAL EXAMINER



  
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EXTERNAL EXAMINER

## ABSTRACT

The present study summaries the Selection of fin materials for different applications. Fins are having different applications such as Economizers, Heat Exchangers etc. Due to the continuous running of moto wall subjected to high temperature and heat transfer takes place through the fins. If the heat is not dissipated properly then it decreases the working efficiency of the motor and burnt. Mostly the heat transfer rate through the fin material is depending on the thermal conductivity and other properties of the chosen material.

This project is about a comparative study of different types of materials for fins. The main aim of this research is to optimize the cooling rate of the fin in electric motors. Since now a day's the fossil fuels are deteriorating gradually, so the automobile industry is changing to E-Vehicles.

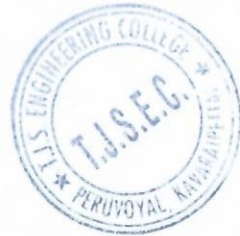
In EV's the motor is the very important part, if that motor has a best design for fins to eliminate heat from the motor then it will be helpful for the efficient running of the vehicle. So, to resolve the heat transfer problem various designs of motor fins are modeled in 3-D modeling software (CREO) and analyzed by the analysis software (Ansys-2020) for their heat transfer properties. To improve the results even more a research has been done and by the help of various research paper study, the materials are selected. Then by the results we can able to find out the best material among the chosen 4 materials.



  
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**OBJECTIVES:**

- To understand the mechanisms of heat transfer under steady and transient conditions.
  - To understand the concepts of heat transfer through extended surfaces.
  - To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.
- (Use of standard HMT data book permitted)



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**BONAFIDE CERTIFICATE**

Certified that this project report "DESIGN AND ANALYSIS OF CAR CRASH ELEMENT" is the bonafide work of "M. ATHIQHUR RAHMAN (112818114005), D. MOULI CHANDRU (112818114028), P. RAJESH (112818114035), M. MOHAMMED ALTHAF (112818114701)", who carried out the project work under my supervision.

  
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**SIGNATURE**

Dr. K. KAMAL BABU , Ph.D.(NIT-T)  
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**ASSOCIATE PROFESSOR**

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Submitted for project viva - voce examination held on 22/06/22

  
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**INTERNAL EXAMINER**

  
**EXTERNAL EXAMINER**

  
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## ABSTRACT

Today occupant safety is of a prime concern to every car manufacturer. New standards are being set for the safety of the occupant in different crash scenarios like frontal head on collision, angle impacts, side impacts, rear impacts and rollover.

In the contemporary world, fuel consumption also poses a serious issue that has to be considered. With these constraints in consideration, a lighter and stronger composite material is used in car front rail than steel. Using this material would help in reducing the fuel efficiency without sacrificing the safety of the vehicle.

In this project, the conventional material used for front sub frame rails in car, steel is replaced with the composite materials Carbon Epoxy and Glass Carbon. 3D model of the sub frame rail is done in CATIA v5. Impact analysis is done in Ansys workbench for all the materials to compare the displacements and stresses at different speeds 80km/hr., 100km/hr. and 120km/hr.



  
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**REFERENCES:**

1. Bhatti Asghar M, "Fundamental Finite Element Analysis and Applications", John Wiley & Sons, 2005 (Indian Reprint 2013)\*
2. Chandrupatla & Begundu, "Introduction to Finite Elements in Engineering", 3rd Edition, Prentice Hall College Div, 1990
3. Logan, D.L., "A first course in Finite Element Method", Thomson Asia Pvt. Ltd., 2002
4. Rao, S.S., "The Finite Element Method in Engineering", 3rd Edition, Butterworth Heinemann, 2004
5. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2002.



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**OBJECTIVES:**

- To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.
- To understand the standard procedure available for Design of Transmission of Mechanical elements
- To learn to use standard data and catalogues  
(Use of P S G Design Data Book permitted)

**UNIT I DESIGN OF FLEXIBLE ELEMENTS** 9

~~Design of Flat belts and pulleys~~ - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

**UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS** 9

Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects – Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane-Equivalent number of teeth-forces for helical gears.

**UNIT III BEVEL, WORM AND CROSS HELICAL GEARS** 9

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits-terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

**UNIT IV GEAR BOXES** 9

~~Geometric progression~~ - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh gear box - Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.

**UNIT V CAMS, CLUTCHES AND BRAKES** 9

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-Electromagnetic clutches. Band and Block brakes - external shoe brakes – Internal expanding shoe brake.

**TOTAL : 45 PERIODS**

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**OUTCOMES:**

Upon the completion of this course the students will be able to

- CO1 apply the concepts of design to belts, chains and rope drives.
- CO2 apply the concepts of design to spur, helical gears.
- CO3 apply the concepts of design to worm and bevel gears.
- CO4 apply the concepts of design to gear boxes .
- CO5 apply the concepts of design to cams, brakes and clutches

**TEXT BOOKS:**

1. Bhandari V, "Design of Machine Elements", 4<sup>th</sup> Edition, Tata McGraw-Hill Book Co, 2016.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8<sup>th</sup> Edition, Tata McGraw-Hill, 2008.

**REFERENCES:**

1. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8<sup>th</sup> Edition, Printice Hall, 2003.
2. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
3. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000.
4. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4<sup>th</sup> Edition, Wiley, 2005
5. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.



  
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