FACULTY OF ENGINEERING & TECHNOLOGY

Effective from Academic Batch: 2022-23

Programme: **Bachelor of Technology (Automobile Engineering)**

Semester: **V**

Course Code: **202010505**

Course Title: **Automotive Heat Transfer**

Course Group: **Professional Elective Course-I**

Course Objectives: This course imparts the comprehensive knowledge of various modes of heat transfer viz., conduction, convection, and radiation. Students also learn the phenomena of heat transfer during phase change of boiling and condensation heat transfer. The course provides practical exposure to the heat transfer equipments like, heat exchangers, heat pipes, fins, automotive radiator, etc. The Heat transfer applications in running system of automobile engineering is also covered.

Teaching & Examination Scheme:

Contact hours per week			Course Credits	Examination Marks (Maximum / Passing)				
				Internal		External		Total
Lecture	Tutorial	Practical		Theory	J/V/P*	Theory	J/V/P*	
3	0	2	4	50 / 18	25 /9	50 / 17	25 / 9	150 / 53

* **J**: Jury; **V**: Viva; **P**: Practical

Detailed Syllabus:

Sr.	Contents	Hours
1	**Fundamental & Application in Automobile Engineering:** Applications in automobile engineering, Modes of heat transfer, effect of temperature on thermal conductivity of different solids, liquids and gases, derivation of generalized equation in Cartesian, cylindrical and spherical coordinates, General laws of heat transfer.	04

Opp. Shastri Maidan, Beside BVM College, Vallabh Vidyanagar, Dist: Anand, Gujarat - 388120
(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in

2	**Heat Transfer by Conduction:** Fourier's law, One dimensional steady state conduction, heat conduction through plane and composite walls, cylinders and spheres, electrical analogy, critical radius of insulation for cylinder and sphere, overall heat transfer coefficient.	**07**
3	**Heat transfer from extended surface:** Types of fin, heat flow through rectangular fin, infinitely long fin, fin insulated at the tip and fin losing heat at the tip, efficiency and effectiveness of fin, Biot number.	**04**
4	**Heat Transfer by Convection:** Newton's law of cooling, Dimensional analysis applied to forced and free convection, dimensionless numbers and their physical significance, empirical correlations for free and forced convection Continuity, momentum and energy equations, thermal and hydrodynamic boundary layer, Blasius solution for laminar boundary layer, General solution of Von-Karman integral momentum equation.	**08**
5	**Heat Transfer by Radiation:** Absorptivity, reflectivity and transmissivity, black, white and grey body, emissive power, emissivity, Kirchhoff's law, Planck's law, Rayleigh-Jeans' law, Wien's law, Wien's displacement law, Stefan-Boltzmann law, intensity of radiation, radiation heat exchange between black bodies, shape factor, electrical analogy, radiation heat exchange between gray bodies, radiosity, irradiation, radiation shields.	**07**
6	**Heat exchanger:** Classification, heat exchanger analysis, LMTD for parallel and counter flow exchanger, condenser and evaporator, overall heat transfer coefficient, fouling factor, correction factors for multi pass arrangement, effectiveness-NTU method for parallel and counter flow heat exchanger. **Automobile Heat exchangers**: Different types of heat exchanger used in vehicles.	**08**
7	**Automobile applications of Heat Transfer:** Radiator construction, Engine Cooling system construction, coolant properties. Design parameters for radiator & water pump design, hoses, Thermostat Valve, Radiators Cap, Radiator fan, Radiator Fan shroud, Surge Tank. Design parameters and Synchronization of vehicular Engine cooling system for dissipation of heat generated in Engine.	**07**
	Total	**45**

Opp. Shastri Maidan, Beside BVM College, Vallabh Vidyanagar, Dist: Anand, Gujarat - 388120
(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in

List of Practicals / Tutorials:

1	To determine the thermal resistance as well as thermal conductivity of Composite wall apparatus.
2	To determine the thermal conductivity of asbestos – magnesia powder and glass wool by using lagged pipe apparatus.
3	To determine the thermal conductivity of insulating powder packed in a copper sphere.
4	To determine the convective heat transfer co-efficient from a natural convection apparatus.
5	To determine the efficiency and effectiveness from a pin fin apparatus.
6	To observe the pool boiling phenomena and to determine the critical heat flux at different bulk temperature.
7	To determine the LMTD as well as heat flow rate from the parallel flow & counter flow heat exchanger.
8	Demonstration of Unsteady state heat transfer apparatus.
9	To find the emissivity of a given test plate by using the emissivity measurement apparatus.
10	Demonstration of Stefan Boltzmann constant from a Stefan Boltzmann apparatus.

Reference Books:

1	Heat and Mass Transfer by P.K. Nag, McGraw Hill.
2	Heat and Mass Transfer: Fundamentals and Application by Yunus Cengel, McGraw Hill.
3	Fundamental of Heat and Mass Transfer by Incropera and Dewitt, Wiley Publication.
4	Heat Transfer by Mills and Ganesan, Pearson Education.
5	Heat Transfer by J P Holman, McGraw Hill.
6	Heat and Mass Transfer by R K Rajput, S. Chand Publication.
7	Heat and mass transfer by D.S. Kumar, S. K. Kataria & Sons.

Supplementary learning Material:	
1	NPTEL Resources

Pedagogy:

- Direct classroom teaching
- Audio Visual presentations/demonstrations
- Assignments/Quiz
- Continuous assessment

Opp. Shastri Maidan, Beside BVM College, Vallabh Vidyanagar, Dist: Anand, Gujarat - 388120
(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in

Internal Evaluation :

The internal evaluation comprised of written exam (40% weightage) along with combination of various components such as Certification courses, Assignments, Mini Project, Simulation, Model making, Case study, Group activity, Seminar, Poster Presentation, Unit test, Quiz, Class Participation, Attendance, Achievements etc. where individual component weightage should not exceed 20%.

Suggested Specification table with Marks (Theory) (Revised Bloom's Taxonomy):

Distribution of Theory Marks						**R**: Remembering; **U**: Understanding; **A**: Application, **N**: Analyze; **E**: Evaluate; **C**: Create
R	**U**	**A**	**N**	**E**	**C**	
20%	25%	25%	20%	5 %	5 %	

Course Outcomes (CO):

Sr.	Course Outcome Statements	%weightage
CO-1	Understand Heat transfer by conduction and other extended surfaces.	**25 %**
CO-2	Understand heat transfer by convection.	**15 %**
CO-3	Understand heat transfer by radiation.	**15 %**
CO-4	Understand principle and application by heat exchangers and other devices.	**20 %**
CO-5	Understand heat transfer application in Automobile Engineering.	**25 %**

Curriculum Revision:	
Version:	2
Drafted on (Month-Year):	June-2022
Last Reviewed on (Month-Year):	
Next Review on (Month-Year):	June-2027

Opp. Shastri Maidan, Beside BVM College, Vallabh Vidyanagar, Dist: Anand, Gujarat - 388120
(O): 02692-238001 | Email: adminoffice@cvmu.edu.in | www.cvmu.edu.in