MEF317: Engines, Motors & Mobility – Assignment

Total Marks: 20

Deadline: 27th November 2025, 5:00 PM

Choose one commercially available Electric Vehicle. Collect realistic technical specifications from manufacturer datasheets / teardown reports / peer-reviewed literature.

Include a table summarizing (with cited sources):

- Battery capacity (kWh), pack voltage, cell configuration
- Cell chemistry (e.g., LFP, NMC, NCA) and key material composition
- Operating temperature window
- Rated charging power / C-rate
- Vehicle use-case profile (urban, highway, mixed – *justify*)

(Evaluation will provide marks depending on interpretation, e.g., why chemistry choice suits expected duty cycle, etc.)

Estimate heat generation in the battery pack during a typical Normal driving, and Fast charging, City ride/Highway mode etc. If you are using MATLAB, include code in appendix. You may also utilize the trial software license provided by ANSYS as part of the proposed workshop (optional). Tabulate results and comment on thermal risk. Design one thermal management approach:(Air cooling (forced/natural), Liquid cooling plate (glycol-based), PCM cooling, Heat pipe-assisted cooling, Refrigerant-based cooling (direct expansion)). Explain the heat flow path and why it has been chosen and provide reasoning for geometry, flow layout, and placement. Also state the advantages & limitations. You may use softwares or try out an equivalent thermal resistance network model.

Also, answer the following:

(a) Choose ONE future battery technology (Sodium-ion / Li-S / Solid-state / Zn-Air) and summarize why it may or may not replace today's Li-ion in mobility applications. (300 words)

(b) India is rolling out E20 petrol (20% ethanol blend). Write a concise engineering commentary addressing: (i)Quantitatively discuss how E20 alters key fuel/combustion properties (e.g., heating value, latent heat, RON, change in stoichiometric AFR, etc.) and (ii) Identify any specific vehicle subsystems requiring adaptation (e.g., injector sizing, ECU spark timing maps, cold-start strategy, elastomer compatibility, etc.) (max 600 words).

Evaluation Criteria:

Meaningful justification of chosen EV and chemistry (not copied tables), Correct formulas/models, calculations, reasoning, clear steps, original sketch of the proposed cooling strategy, explanation of why *this* design works, critical discussions, report structure and format, originality of the presented data and interpretation and quantitative effects and identified engine adaptation reasoning (for the last two questions).

Submission: One PDF (max page limit of 12 (times new roman font with 12 font size and 1.5 spacing) excluding the citations and codes if any) uploaded to Turnitin link and Nalanda.

Similarity & AI Policy: Similarity limited to 25% (max). Peer copying may result in award of zero marks. The report will undergo Turnitin plagiarism and AI-generated text detection. Generic AI-generated text without interpretation receives *no* technical reasoning marks.