Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

FIRST SEMESTER M.TECH. (ELECTRIC VEHICLE TECHNOLOGY)

END SEMESTER EXAMINATIONS, NOV-DEC 2023

AUTOMOTIVE POWER TRAINS [AAE 5126]

REVISED CREDIT SYSTEM

Time: 3 Hours **Date: 30th November 2023** **Max. Marks: 50**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.

1A. With a neat sketch, illustrate the features of a front engine, four-wheel drive power train layout for a four wheeled vehicle. ***(03)***

1B. Compare the spark ignition and compression engines based on the following parameters.

i. Power to weight ratio
ii. Thermal efficiency
iii. Noise-vibrations- Harshness
iv. Mean effective pressure ***(03)***

1C. An engine uses 6.5 kg of fuel/hr of CV=30000 kJ/kg,

If it develops a shaft power of 22 kW with mechanical efficiency being 85%, Determine the

(i) Indicated thermal efficiency,
(ii) Brake thermal efficiency,
(iii) Brake specific fuel consumption. ***(04)***

2A. Discuss the working of any one type of new generation engine valve actuation mechanism with a neat sketch. ***(03)***

2B. Discuss any four features of modern HEV engines considering the optimization of fuel consumption and emissions ***(03)***

2C. A clutch has 3 discs on driving shaft and 2 on the driven shaft. The inner diameter of contact surface is 125 mm. The maximum pressure between the surfaces is limited to 0.0001 kN/mm^2. Design the clutch for transmitting 30 kW at 1600 RPM. Friction coefficient across the contact surfaces is 0.3 ***(04)***

3A. Illustrate the working principle of any one type of friction clutch with a relevant diagram. ***(03)***

3B. Plot typical characteristics of I C Engines for

i. Torque vs Speed

ii. Power vs Speed

iii. Thermal efficiency vs Speed ***(03)***

3C. Gross Vehicle Weight of a vehicle is 60000 N, with its frontal area being 5.6 m^2. Overall Gear Ratio in top gear is 6.2:1 with an efficiency of 90% and in second overall Gear Ratio of 15:1 is 80%. If coefficient of friction resistance is 0.018, and coefficient of air resistance is 0.0276, wheel diameter is 81 cm and the speed of the vehicle in top gear on level road is 85 kmph,

Find (i) Power required for propulsion

(ii) Engine speed

(iii) Maximum grade at above engine speed ***(04)***

4A. With a neat sketch, illustrate the working principle of a synchromesh unit. ***(03)***

4B. With a relevant diagram, illustrate the working of an automotive differential. ***(04)***

4C. A motor car Prop shaft of steel tube with outer diameter of 4 cm and thickness of 3 mm is used in the driveline. Engine develops 9 kW at 1200 RPM. What will be the maximum stress in the tube when the power is transmitted through 4:1 gearing? ***(03)***

5A. Define the following:

(i) Critical speed of shaft

(ii) Diametral pitch of gears

(iii) Clutch judder

(iv) Brake specific fuel consumption ***(04)***

5B. Differentiate the following:

(i) Universal joint and Slip joint

(ii) Dog clutch and Synchromesh device

(iii) Worm-wheel final drive and Hypoid final drive ***(03)***

5C. Power developed by an engine is 17.16 kW at 2000 RPM. Final drive consists of a pinion with 6 teeth and ring gear with 28 teeth. In the direct gear driving on a curved path, the inside wheel makes 60 RPM. Calculate the torque and power at the inner and outer driving wheels, considering a transmission efficiency of 95%. ***(03)***