Mid-Semester Examination
Second Semester 2022-2023

Birla Institute of Technology and Science, Pilani
ME F441: Automotive Vehicles

Close Book   30 Marks   09:00-10:30 AM, 18/03/2023

Instructions: *1. Please write concisely and legibly. Final answers should be clearly marked.*
2. Draw neat labelled diagrams wherever necessary.
3. Assume any data if you feel missing, and clearly mention the same.
4. All questions are compulsory.

1. (a) What is a Torque Converter? Explain its working and functions in an automatic transmission.   **[4]**

(b) Explain why 2-stroke engines are not preferred in modern passenger automotive vehicles.   **[2]**

(c) How does an open differential gear box work? Draw a schematic diagram of hypoid gear type open differential and explain its features.   **[4]**

2. (a) Consider a four-wheel vehicle descending a hill (θ = inclination from horizontal) when brakes are applied on the rear wheels. Derive the expressions for retardation of the vehicle, and reactions on the front and rear wheels in terms of design parameters.   **[6]**

 (b) Determine the maximum, minimum and average pressure in a plate clutch when the axial force is 4 kN. The inside radius of the contact surface is 50 mm and the outside radius is 100 mm. Assume uniform wear.   **[4]**

3. (a) The following observations were made during a test on an oil engine:

Brake power = 30 kW; Fuel used = 10 kg/h; Calorific value of fuel = 42,000 kJ/kg; Jacket circulating water = 9 kg/min; Rise in temperature of cooling water = 60°C;

The exhaust gases are passed through the exhaust gas calorimeter for determining the heat carried away by exhaust gases.

Water circulated through exhaust gas calorimeter = 9.5 kg/min; Rise in temperature of water passing through the calorimeter = 40°C; Temperature of exhaust gases leaving the calorimeter = 80°C; Air/fuel ratio on mass basis = 20; Ambient temperature = 17°C; Mean specific heat of exhaust gases = 1.0 kJ/(kg K); Specific heat of water = 4.18 kJ/(kg K)

Draw up a heat balance sheet on kJ/min and percentage basis.   **[6]**

(b) Two single-cylinder automotive engines are being compared; the first engine has bore = 80 mm, stroke = 100 mm and compression ratio = 9. The second engine has bore = 85 mm, stroke = 90 mm and compression ratio = 10.5. Find out the stroke volume and total volume for these engines. Find out which engine offers bigger volume in terms of engine size. Which of the engines will offer more power based on the data provided?   **[4]**

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