SIXTH SEMESTER B.TECH. (AUTOMOBILE ENGINEERING)

END SEMESTER EXAMINATIONS, MAY 2024

DRIVELINE SYSTEM OF GROUND VEHICLES [AAE4036]

REVISED CREDIT SYSTEM

Time: 3 Hours   **24/05/2024**   **Max. Marks: 50**

1A. With a neat sketch and governing equations, discuss any four key modes of operations in a parallel hybrid vehicle powertrain. **(4)**

B. Define stability of a vehicle. Discuss the factors that affect vehicle's stability. **(3)**

C. An axle shaft is to be designed for a full floating rear axle, with the following vehicle data.

Maximum engine torque= 200 N-m, Rear axle reduction= 5:1; Gear ratios provided in the transmission: 4, 2.5, 1.4, 1. Transmission efficiency is 90% in all gears. Permissible Shear Stress for axle shaft material = 13700 N/m^2, Calculate the diameter of axle shaft. **(3)**

2A. With neat sketches discuss the constructional details of the following driveline subsystems:

(i) Hotchkiss drive (ii) Semi floating axle. **(4)**

B. With a neat sketch, discuss the principle of working of a limited slip differential. **(3)**

C. An engine develops a torque of 104 N-m at 2500 RPM and drives through a gear box with a Gear Ratio of 4:1. Rear Axle Reduction is 5:1. If the effective wheel radius is 420 mm and Transmission Efficiency is 85%, Determine torque supplied to each half shaft and speed of the vehicle on straight road in kmph. **(3)**

3A. Explain the constructional and working modes of a rear engine 4WD powertrain with a relevant diagram. **(3)**

B. Illustrate the working of a two-speed rear mounted power take off. List typical applications of such systems. **(3)**

C. Discuss the working of a third differential in tandem axle drive systems with WORM-WHEEL final Drives. **(4)**

4A. Two shafts whose axes are intersecting but inclined to each other at 15^0 are connected by a Hook's joint. If shaft A rotates at a uniform speed of 2000 RPM, find the maximum acceleration of the driven shaft.

- $\cos 2\alpha = 2\sin^2(\theta)/(2-\sin^2(\theta))$

- Max acceleration$= -(\omega_A^2 * \cos\theta * \sin^2(\theta) * \sin 2(\alpha))/(1-\cos^2(\alpha)\sin^2(\theta))^2$

B. Differentiate the Automatic all wheel drives and Full time all wheel drives based on working principle and modes of operations. (3)

C. A vehicle with gross vehicle weight 8000 N has an engine developing 14 kW at 2500 RPM. It is running in top gear with 88% Transmission Efficiency at 65 kmph. Low gear ratio is 3.5:1. Transmission Efficiency= 80%. Frontal area= 1.12 m². Air resistance coefficient= 0.0276, Rolling resistance coefficient= 0.023

Find the following:

- Speed of the vehicle in low gear
- Tractive effort in high and low gears
- Tractive effort required to start up on level and attain a speed of 48 kmph in 10 secs. (4)

5A. With a neat sketch, explain the working of a six-speed dual clutch transmission system. (4)

B. List any 6 factors that may give rise to variation in speeds between live front and rear axle wheels and define driveline wind up. (3)

C. A simple epicyclic gear train has sun and annulus gears with 21 and 75 teeth respectively. If the input speed from the engine drives the planet carrier at 3000 RPM, Find the following.

i) Gear ratio with annulus as output ii) Number of planet gear teeth iii) Output shaft speed. (3)