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Question Paper Code : 71126

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2015.

Fifth Semester

Automobile Engineering

AT 2303/AU 53/10122 AU 505 — VEHICLE DESIGN AND DATA CHARACTERISTICS

(Regulations 2008/2010)

Time : Three hours Maximum : 100 marks

Graph sheet is to be supplied.

Assume reasonable data wherever necessary.

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. Write the classifications of light motor vehicle.

2. What is the preferred position of the engine in a car and why?

3. Define coefficient of rolling resistance.

4. How does the vehicle speed effect tyre grip?

5. Write down the formula to calculate frictional mean effective pressure.

6. What is the significance of side thrust acting on the piston?

7. Write typical values of the weight of reciprocating parts corresponding to cylinder bore.

8. Brief Dry weight, Kerb weight and Normal Laden weight.

9. Explain briefly the term gradability.

10. List out the factors responsible for over turning.

PART B — (5 × 16 = 80 marks)

11. (a) Briefly explain the following:

(i) Parameters to be considered in designing a vehicle. (8)

(ii) Factors influencing various resistances to motion. (8)

Or

(b) It is assumed that an automobile engine can operate at a thermal efficiency of 22% when operating conditions are as follows:

Volumetric efficiency of 80%; Mechanical efficiency of 82%; heating value of petrol 46400 kJ/kg; theoretical air required per kg petrol 14.5; excess of air 25%; petrol vapour has density twice the density of air and mixture at the end of suction stroke is at a pressure of 8.24×10^4 N/m^2 and a temperature of 333 K. Gas constant for air is 287.14 J/kg K. Find the cylinder dimensions of a six cylinder engine at the above conditions when the engine develops its rated power of 66 kW at a speed of 4200 rpm. Assume the stroke is 25 % greater than the diameter

12. (a) Write short notes on:

(i) Rolling resistance (6)

(ii) Gradient resistance (6)

(iii) The procedure to draw driving force curve from the acceleration curve. (4)

Or

(b) Discuss through suitable illustration of graphs drawn with vehicle speed versus total resistance and Tractive effort, the optimum performances of the vehicle at different gear ratios.

(i) When the vehicle is traveling on level road and (8)

(ii) When the vehicle is traveling upward in a gradient of 1 in 20. (8)

13. (a) Discuss in detail design variables and operating variables affecting performance and Emissions of a vehicle.

Or

(b) Draw PV diagram of a four stroke S.I engine with a compression ratio 9:1 and suction pressure is 0.97 kg/cm^2. Assume all other data.

14. (a) Derive the Expression for velocity and acceleration of the piston in terms of crank angle.

Or

(b) The bore and stroke of engine are $73.02 \times 88.9\ mm$. The ratio of the length of connecting rod to crank radius is 3.85. If the gas pressure corresponding to crank angle of 45 degree is 35 Kg/cm^2. Calculate the side thrust acting on piston skirt at this crank angle.

15. (a) A passenger car weighs 19620 N (gross weight). Its rolling resistance is given by 0.02 × gross weight of vehicle in N. The frontal area of the car is $2\ m^2$ and the air resistance coefficient may be assumed as 0.0343 when vehicle speed is expressed in kmph and air resistance in N:

(i) If the car is traveling on level road at 120 kmph, find the engine power required in kW corresponding to top gear. Transmission efficiency may be assumed as 90% in top gear.

(ii) If the driving force at 40 kmph in top gear is given as 1.3 times the driving force at 120 kmph in top gear, find the vehicle acceleration in m/s^2 corresponding to a speed of 40 kmph.

(iii) Calculate the engine power required in kW to propel the car ascending a gradient of 1 in 6 at a speed of 40 kmph in low gear. The corresponding transmission efficiency is 78.5%.

Or

(b) A truck weighs 61800 N and has a frontal area of $6.65 m^2$. Effective wheel radius = 0.405 m. Maximum vehicle speed in top gear = 80 km/hr. The total resistance on level road is given by:

$R = K\ r\ W + K\ a\ A\ V^2$, (N)

where K = 0.0175

W = gross vehicle weight, (N)

Ka = 0.02796

A = frontal area (m^2)

V = vehicle speed, (km/hr).

The transmission efficiency in top and first gears is 90% and 75% respectively. Rear axle ratio = 6.15. First gear ratio = 5.65. Calculate the following:

(i) Engine power required to propel the vehicle on level road at 80 km/hr in top gear. (6)

(ii) Engine speed corresponding to 80 km/hr in top gear. (6)

(iii) The maximum gradient which the vehicle is capable of ascending in first gear corresponding to the above engine speed. (4)