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B.E / B.TECH. DEGREE EXAMINATION, May 2023

Sixth Semester

AE18604 – VEHICLE DESIGN DATA CHARACTERISTICS

(Automobile Engineering)

(Regulation 2018)

TIME:3 HOURS

MAX. MARKS: 100

- CO 1 Examine the assumptions in basic design of vehicle and discuss the effect of design and operating variables on performance and emission.
- CO 2 Examine and compare the various resistances acting on the vehicle.
- CO 3 Investigate the performance characteristics of internal combustion engines.
- CO 4 Solve velocity and acceleration of piston against crank angle and examine the performance characteristic of forces and moments acting on the piston.
- CO 5 Use the basic principles to design the gearbox of the vehicle.

PART- A(10x2=20Marks)

(Answer all Questions)

	CO	RBT LEVEL
1. How can you classify the vehicle corresponding to engine displacement?	1	2
2. Differentiate the Kerb weight and Dry weight of the vehicle.	1	2
3. In what way does the vehicle projected frontal area and vehicle speed influence the motion of the vehicle?	2	3
4. With the help of suitable illustration, how will you determine the vehicle speed at maximum acceleration for a small passenger car?	2	3
5. How do you calculate indicated mean effective pressure?	3	2
6. Compare the under square and over square engine.	3	2
7. Illustrate the turning moment diagram for a typical single cylinder four stroke engine.	4	3
8. Discuss the effect of coefficient of fluctuation of energy.	4	2
9. What is the necessity of a gear box in an automobile?	5	2
10. Elucidate the importance of the over drive in a transmission system.	5	2

PART- B (5x 14=70Marks)

	Marks	CO	RBT LEVEL
11. (a) (i) Discuss about the operating variables which are affecting performance of an engine.	(7)	1	2
(ii) With a neat sketch explain the performance curves for the following characteristics of an automotive diesel engine: Variations of Brake	(7)	1	2

Power, Frictional Power, Indicated Power, Torque, Brake mean effective pressure, Mechanical efficiency and Fuel consumption against the engine Speed.

(OR)

- (b) Plot and explain typical performance curves which include acceleration, gradability and drawbar pull for a passenger car based on road speed. (14) 1 2
- 12. (a) With the specification of a model car, calculate the rolling resistance, air resistance, total resistance and tractive force at any velocity. (14) 2 3

(OR)

- (b) The coefficient of rolling resistance for a truck weighing 62 kN is 0.018 and the coefficient of air resistance is 0.0276 in the formula $R = KW + KaAV^2$ N, where A is m² of frontal area and V the speed in km/h. The transmission efficiency in top gear of 6.2: 1 is 90 % and that in the second gear of 15: 1 is 80 %. The frontal area is 5.57 m². If the truck has to have a maximum speed of 88 km/h in top gear, calculate: (14) 2 3
 - i) The engine brake power required,
 - ii) The engine speed if the driving wheels have an effective diameter of 0.81 m,
 - iii) The maximum grade the truck can negotiate at the above engine Speed in second gear and
 - iv) The maximum draw bar pull available on level at the above engine speed in second gear.

- 13. (a) With the help of the following small car engine data find the cubic capacity, bore, stroke length of the engine and plot the variation of torque and mechanical efficiency with respect to engine speed where N is the engine speed in rpm and BHP is the Brake horse power. (14) 3 3

N in rpm	455	911	1367	18200	2270	2734	3190	3646	4100	4558	5150
BHP in HP	4.38	9.812	15.92	21.62	26.71	30.81	33.72	35.92	37.87	39.16	38.94

(OR)

- (b) In a car with 4 cylinder, four stroke petrol engine having 101.6 mm bore and 132 mm stroke, the net dynamometer load is 183 N at a radius of 508 mm when the speed is 2500 rpm. At this speed and throttle opening the engine requires 4.6 kW to motor it with ignition switched off. (14) 3 3

- i) Calculate the mechanical efficiency and the indicated mean effective pressure.
- ii) During the 3 minutes run at this speed and power, the engine used 0.598 kg of petrol of heating value 45310 kJ/kg and 22.68 kg of cooling water with a temperature rise of 55.5 K. Specific heat of the water is taken as 4.18 kJ / kgK. Draw the heat balance chart of the test in kJ/min.

14. (a) Derive the equations for calculating the displacement, velocity and acceleration of piston and connecting rod of an IC engine. (14) 4 3

(OR)

(b) A petrol engine is of 80 mm diameter and 100 mm stroke, the ratio of connecting rod length to crank length is 4 and the crank length is 50 mm. The piston has a mass of 1 kg. The engine speed is 2000 rpm. The gas pressure on the piston is 6×10^5 Nm, when it has moved from 40° from inner dead centre. Determine:

- i) Net load on piston,
- ii) Net load on gudgeon pin and crank pin,
- iii) The thrust on the cylinder walls,
- iv) The speed above which the gudgeon pin load would be zero, the other things remaining the same.

(OR)

15. (a) Explain the procedure to calculate the gear ratios for a small car considering gradability of 38%. (14) 5 3

(OR)

(b) A four speed gear box is to be constructed for providing the ratios of 1.0, 1.46, 2.28 and 3.93 to 1 as nearly as possible. The diametral pitch of each gear is 3.25 mm and the smallest pinion is to have at least 15 teeth. Determine the suitable number of teeth of the different gears and the distance between the main and lay shaft. Also sketch the layout of a typical constant mesh gear box for these conditions. (14) 5 3

PART- C (1x 10=10Marks)

(Q.No.16 is compulsory)

	Marks	CO	RBT LEVEL
16. Discover and explain the method to measure the frictional power of a multi cylinder SI engine.	(10)	3	3