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B.E. / B.TECH. DEGREE EXAMINATIONS, DEC 2019
 Fifth Semester
AE16504 – VEHICLE DESIGN DATA CHARACTERISTICS
(Automobile Engineering)
(Regulation 2016)

Time: Three Hours

Maximum : 100 Marks

Answer ALL questions

PART A - (10 X 2 = 20 Marks)

	CO	RBT
1. Discuss the horse power required to propel the vehicle.	1	U
2. Mention various design considerations of a vehicle.	1	R
3. Draw acceleration Vs Vehicle speed curve for a small car.	2	AP
4. Define the term air resistance with the factors affecting the same.	2	R
5. List the factors which contribute the losses in the mechanical efficiency in IC engines.	3	R
6. Distinguish between ideal and actual pressure and volume diagram for petrol engine.	3	AP
7. Discuss the coefficient of fluctuation of speed.	4	U
8. Write the equation required for the calculation of reciprocating mass of an engine.	4	R
9. How are intermediate gears decided for a gear system?	5	AP
10. Summarize the advantages of automatic transmission.	5	U

PART B - (5 X16 = 80 Marks)

11. (a) Illustrate and explain typical performance curves which include acceleration, gradability and drawbar pull for a passenger car based on road speed. (16) 1 U
- (OR)**
- (b) Discuss in detail design variables and operating variables affecting performance of an engine. (16) 1 U
12. (a) With the specification of a model car, calculate the rolling resistance, air resistance, total resistance and tractive force. (16) 2 AN
- (OR)**
- (b) A truck weighs 100111 N and the engine develops 97 kW at 2400 rpm. The transmission efficiency is 90% in top gear of 3.4:1 and 85% in third gear of 8.4:1. The performance of the vehicle is such that it will just reach a speed of 86.8 km/hr at 2400 rpm at wide open throttle when running on the level in still air, and at the same engine speed in third gear it will just climb a gradient of 1 in 14. If the total resistance in N is given by the formula.

$$R = KW + K_a AV^2 + W \sin \theta$$

Where K is Coefficient of Rolling resistance, K_a is Coefficient of Air resistance, A is m^2 of frontal area and V the speed in km/h.
 calculate

- i) K and K_a and hence the engine power required for climbing a grade of 1 in 40 at 48 km/h in top gear.
- ii) How much more weight can be added the vehicle to use the engine power fully under the above condition. Front area of truck = 5.575 m².

13. (a) Draw a pV diagram of a 4-stroke petrol engine with a compression ratio 8:1. Assume the suction pressure as 0.97 kg/cm². Assume all other data. **(16) 3 AN**

(OR)

(b) In a trial on 4-cylinder, 4-stroke petrol engine of 101.6 mm bore and 127 mm stroke, the net dynamometer load was 183 N at a radius of 508 mm when the speed was 2500 rpm. At this speed and throttle opening the engine required 4.6 kW to motor it with ignition switched off. **(16) 3 AN**

- 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 4.18 kJ/kg-K.

14. (a) Obtain the expression for Piston Side thrust, Connection Rod forces and Turning moment on the crankshaft. **(16) 4 AN**

(OR)

(b) A petrol engine is of 100 mm diameter and 125 mm stroke, the ratio of connecting rod length to crank length as 4 and the connecting rod length is 250 mm. The piston has a mass of 1.15 kg. The engine speed is 2000 rpm. On explosion stroke with the crank 20° from The TDC the gas pressure is 0.7 MPa. Determine **(16) 4 AN**

- i) Net force on piston
- ii) The resultant load on gudgeon pin
- iii) The thrust on the cylinder walls
- iv) The speed above which the gudgeon pin load would be reversed in direction, the other things remaining the same.

15. (a) An automotive gearbox gives three forward speeds and reverses with a top gear of unity and bottom and reverse gear ratio of approximately 3.3:1. The centre distance between the shafts is to be 110 mm approximately. Gear teeth of module 3.25 mm are to be employed. Sketch the layout of a typical constant mesh gear box for these conditions giving the number of teeth for the various gear wheels and showing closely how the different ratios are obtained. **(16) 5 AP**

(OR)

(b) Explain the need for a gearbox in the automobile. Briefly explain the procedure of calculation of gear ratios for a small car. **(16) 5 AP**