Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

Course Code: AU401
Course Name: AUTOMOTIVE SYSTEM DESIGN

Max. Marks: 100 Duration: 3 Hours

NOTE:

1. Assume suitable data, if not given

PART A

Answer any two full questions, each carries 15 marks. Marks

1 a) An engine is required to power a truck having a gross weight of 40937 N. The maximum grade which the truck will have to negotiate at 32 km/hr in second gear is 15%. K=0.017 and K_a=0.0324, total resistance is given by $R=KW+K_aAV^2$. Frontal area is 5.2 m^2 and transmission efficiency is 80%. Calculate minimum power available at 2400 rpm and gear ratio in second gear if effective radius is 0.419 m. Also calculate maximum speed in top gear on level road at same engine speed assuming transmission efficiency 90%. What is gear ratio in top gear. Differential has a reduction of 3.92. (15)

2 a) It is assumed that an automobile engine can operate at a thermal efficiency of 22% under the following operating conditions: Volumetric efficiency of 80%; mechanical efficiency of 82%; Calorific value of 46400kJ/kg; Theoretical air required per kg of fuel 14.5kg; Excess of air 25%; petrol vapour has density twice the density of air; the mixture at the end of suction stroke is at a pressure of 8.24x 10^4 N/m^2 and the temperature is 333K. Gas constant for air is 287.14J/kg K
Find the cylinder dimensions of a six cylinder engine at the above conditions when the engine develops a rated power of 66kW @4200rpm. Assume that the stroke is 25% greater than the diameter (15)

3 a) The observation obtained during the trail on a four stroke cycle engine is as follows: bore = 240 mm, stroke = 400 mm, Speed = 250 rpm, Number of explosions = 115 (15)

per minute, Mean effective pressure =6.65 bar, Net load = 850 N, Radius of brake drum = 750 mm, Gas supplied = 0.21 m^3 per minute at 0^oC, CV of gas = 18650 kJ/ m^3. Calculate 1) Brake Power 2) Indicated Power 3) Mechanical Efficiency and 4) Indicated thermal efficiencies on IP and BP basis.

PART B

Answer any two full questions, each carries 15 marks.

4 a) Design a gear oil pump and centrifugal oil filter for the following specifications for a petrol engine: (15)

Total heat developed= 221.92kJ/s; Thermal capacity of oil= 2.092kJ/kgK; Oil density = 900kg/m3; Volumetric efficiency of oil pump =70%; Gear module=4.5mm; No. of gears =7; Peripheral velocity of the gear outer diameter= 6.36m/s; the oil working pressure =40 x 104 Pa; Mechanical efficiency of the pump= 87%, Co-efficient of contraction= 1.0; Centrifuge capacity = 20% of total capacity; Centrifuge nozzle diameter =2mm; Distance from nozzle axis to the rotor rotation axis = 40mm; Moment of resistance at the beginning of rotor rotation= 1x10-3 Nm; Rate of increase of moment growth= 6x 10-6 Nm/rpm; Rotor axle radius = 8mm; Co-efficient of oil flow through the nozzle= 83%; Co-efficient of hydraulic losses= 0.15

5 a) What is the Harmonic cams design procedure (15)

6 a) List down the functions of a lubrication system in an automobile. (3)

b) Find the cooling surface area for an oil cooler with the following data (12)

Heat to be taken =4670W; Co-efficient of heat transfer from oil to the cooler= 250W/m^2K; Cooler wall thickness =0.2mm; Co-efficient of wall heat conductivity= 100W/m K; Co-efficient of heat transfer from cooler wall to water= 3200 W/m^2K; Mean temperature of oil and water in the cooler is 358K and 348K respectively.

PART C

Answer any two full questions, each carries 20 marks.

7 a) Design a cooling fan for a carburettor engine. Mass flow rate of air supplied by the fan 2.52 kg/s and its mean temperature 325 K, the head produced by the fan = 800 Pa. (10)

b) Design a cooling fan for a diesel engine. Mass flow rate of air supplied by the fan 6.59 kg/s and its mean temperature 327 K, the head produced by the fan = 900 Pa. (10)

8 a) Design a 12-speed gear box for an all geared headstock of a lathe. Maximum and minimum speeds are 600 r.p.m. and 25 r.p.m respectively. The drive is from an electric motor of 2.25 kW at 1400 r.p.m. (20)

9 a) A 9 speed gearbox needs to provide an rpm range of 180rpm to 1800 rpm. Using step ratio draw the speed diagram and the kinematic layout.. Check the percentage deviation of the obtained speed from the calculated speeds (20)

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