Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Examination (Regular and Supplementary), December 2020

Course Code: AU401

Course Name: AUTOMOTIVE SYSTEM DESIGN

Max. Marks: 100 Duration: 3 Hours

Note: Logically assume values which are not provided.

APJKTU approved data book is permitted for the examination.

PART A

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

1 a) List down the parameters that contribute to the air resistance of a vehicle. Provide the equation to calculate the same. (5)

b) A lorry with a GVW of 39868N is travelling up a gradient of 1 in 20 at a speed of 32km/h. The road resistance is 23 N per 1000N. There is a head wind blowing at 16km/h. Determine the power required to propel the vehicle under the given condition if the projected area is 2.8m^2. Take the value of K_a as 0.03708 and the efficiency of transmission is 85%. (10)

2 a) Explain the following terms: i).Tractive effort; ii) Indicated mean effective pressure; iii)Frictional horse power; iv) Excess driving force (8)

b) Explain the methodology to graphically determine the maximum acceleration that can be obtained from a vehicle. (7)

3 Derive the equation for finding the velocity, acceleration, angular velocity, angular acceleration and inertia force due to reciprocating masses in an engine cylinder. (15)

PART B

Answer any two full questions, each carries 15 marks.

4 Design a valve gear with convex cam profile for the following details: (15)
Cylinder Bore=75mm; Engine speed at nominal power = 5600rpm;; Mean piston speed= 14m/s; Mixture velocity in the seat passage section at maximum lift of inlet valve= 95m/s; Angle of opening of inlet valve 16° BTDC; Angle of closing of inlet valve = 50° after BDC.

5 List down the procedure for finding the parameters for a harmonic cam profile. (15)

6 Design a lubrication system consisting of gear oil pump, centrifugal oil filter and oil cooler for the following specifications for a petrol engine: (15)

Total heat developed= 351.56kJ/s; Thermal capacity of oil= 2.092kJ/kgK; Oil density = 900kg/m^3; Volumetric efficiency of oil pump =70%; Gear module=4.5mm; No. of gear teeth =7; Peripheral velocity of the gear outer diameter= 6.36m/s; the oil working pressure =80 x 10^4 Pa; Mechanical efficiency of the pump= 91%, 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; 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 Design a cooling system considering the following details: Amount of heat carried away by water= 60510J/s; Mean specific heat of water= 4187J/kgK; Head produced by pump= 90kPa; Pump speed =3600rpm; Temperature difference of water= 10K; Volumetric efficiency of pump=80%; Water velocity at inlet= 2m/s; Impeller hub radius- 15mm; Angle between u_2 and v_2= 12^o, Angle between u_2 and w_2= 45^o, Hydraulic coefficient= 0.68; Angle between u_1 and v_1=90^o; No. of blades of the impeller =4; Blade thickness= 3.2mm; Mechanical efficiency of pump= 85%; mean specific heat of air=1000kg/m^3; Flow rate of water passing through the radiator= 0.00151m^3/s; Temperature difference of the air in the radiator grille= 24^oC; Head produced by the fan= 800Pa; Air velocity upstream radiator= 22m/s; The fan employs flat blades and is riveted type. (20)

8 Select a 9 speed gearbox to provide output speeds between 280 and 1800 rpm. The input power is 5.5kW @1400rpm. Draw the kinematic layout and the speed diagram. (20)

9 Find the number of teeth of gears and provide the final kinematic arrangement marking number of teeth. Take minimum number of teeth as 15. (20)

****