ME C441 AUTOMOTIVE VEHICLES

COMPREHENSIVE EXAMINATION

DATE: 24-05-09

DURATION: 3 Hrs.   MAXIMUM MARKS: 40   WEIGHTAGE: 40%

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1.   List and explain the major losses in an actual engine. Give the typical values for the various losses (in %) compared to the air standard cycles.   **3**

2.   Define "Octane Number" and 'HUCR' for SI engine fuel. With a neat sketch explain the air- cell combustion chamber used in CI engines. List out its merits and demerits of it compared to the Direct Injection chambers.   **4**

3.   A 8.5 cm (dia) * 8.8 cm (stroke) four cylinder, four stroke cycle SI engine is to have a maximum speed of 3200 rpm and volumetric efficiency of 80%. If the maximum venturi depression is to be 0.1 bar, what must be the size of the venturi? Determine the size of the fuel orifice if an air-fuel ratio of 12 to 1 is desired. Neglect the compressibility of air and assume the air-density as 1.2 kg/m^3. Assume C_{da} = 0.8, C_{df} =0.8 and ρ_f= 750kg/m3.   **6**

4.   A six-cylinder four-stroke gasoline engine having a bore of 90mm and a stroke of 100mm has a compression ratio of 7. The relative efficiency based on the indicated power is 55%. When the ISFC is 300gm/kW-h estimate the calorific value of the fuel and the Total Fuel Consumption in kg/hr, given the indicated mean effective pressure is 8.5 bar and the speed of the engine is 2500 rpm.   **5**

5.   A car of total mass of 1200 kg is traveling in a level road in top gear while the engine is running at 5000rpm. Crown wheel to pinion ratio is 4.3, radius of the wheel tyre is 0.3m and frontal area of the car is 2.2 m^2. Taking the coefficient of the rolling friction as 0.12 N/kg and wind resistance 0.05 N/m^2-(km/h)^2 determine the power developed by the engine to propel the car.   **6**

6.   With a neat diagram explain the construction and working of a simple epicyclic gear train. Explain and derive how different gear ratios are obtained in it.   **4**

7.   Discuss the advantages of an independent suspension system. With a neat sketch explain the working of wishbone type suspension system.   **4**

8.   Explain the functions of a differential. With a neat sketch explain its working. What are the advantages of a limited slip differential?   **4**

9.   With a layout explain the working of a pneumatic braking system. Draw the cross sectional view of brake valve and diaphragm chamber and explain.   **4**

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ME C441 AUTOMOTIVE VEHICLES
TEST 2 (Open Book)*

DATE: 19-04-09

DURATION: 50 MINUTES   MAXIMUM MARKS: 20   WEIGHTAGE: 20%

*Only prescribed textbook, bound Xeroxed copy of the reference book duly signed by the instructor and hand written notes are allowed

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1. Explain what is the use of a helical groove in a fuel injection pump? **3**

2. A test on a single cylinder 4 stroke oil engine having bore of 180 mm and stroke of 360 mm gave the following results.

   Speed = 290 rpm, brake torque – 392 N-m, IMEP = 7.2 bar, oil consumption = 3.5 kg/h, coolant flow = 270 kg/h, cooling water temperature rise – 36 °C, air-fuel ratio by weight = 25, exhaust gas temperature = 415 °C, room temperature = 21 °C. The fuel has a calorific value 45200 kJ/kg and take specific heat of the exhaust gases as 1.0035 kJ/kg-K. Calculate

   a. Indicated thermal efficiency, $\text{TAKE } C_{pw} = 4.18 \text{ kJ/(kg-K)}$

   b. Draw up a heat balance sheet in kJ/min basis. **8**

3. What is clutch pedal "Free play"? How is it adjusted in a single plate clutch? Explain with a simple sketch. **3**

4. What do you mean by double-declutching? Explain how and why it is done? **3**

5. In which gear besides the neutral does the counter shaft turn with out transmitting power in a manual gear box? Explain clearly with a simple sketch. **3**
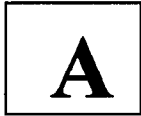
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ME C441   AUTOMOTIVE VEHICLES
<u>TEST 1</u>

DATE: 09-03-09

DURATION: 50 MINUTES   MAXIMUM MARKS: 25   WEIGHTAGE: 25%

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1. How do the specific heats vary with temperature? Explain with the help of a P-V diagram the loss due to variation of specific heats in a fuel – air Otto cycle. **4**

2. A single jet carburetor has to supply 6 kg/min. of air and 0.44 kg/min. of petrol of specific gravity 0.74. The air is initially at 1 bar and 27 °C. Assuming an isentropic coefficient of 1.35 for air , Cp for air = 1.005 kJ/kg-K R for air = 0.287 kJ/kg-K and considering the compressibility of air determine

   a. the diameter of the venturi if the air speed is 90 m/sec and the velocity coefficient of air for venturi is 0.85

   b. the diameter of the fuel jet if the pressure drop at the fuel jet is 0.8 times the pressure drop at the venturi for air and the coefficient of discharge for the fuel jet is 0.66. **8**

3. What do you mean by exhaust blow down? Discuss the optimum opening position of exhaust valve to reduce the exhaust blow down loss. **4**

4. There is a saying that a good SI engine fuel automatically becomes a bad CI engine fuel. Consolidate the statement with suitable facts and discussions with respect to nature of combustion and knocking in both SI and CI engines. **5**

5. Explain the idling system of a carburetor with a simple sketch. **4**

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ME UC441 AUTOMOTIVE VEHICLES
QUIZ 3
(27-04-09)
DURATION: 15 MINUTES   MAXIMUM MARKS: 5 WEIGHTAGE: 5%

Name of the student: ----------------------------------   Id.: ----------------------------

1.   What are the two main functions of a clutch?

2.   What is the use of synchromesh device in a gearbox?

3.   In a fluid flywheel clutch the input shaft speed is 4000 rpm and the output shaft speed is 1000 rpm. Find out the percentage slip.

4.   When a car is running on a level road the tractive effort on the driving wheels is 250 N. If the diameter of the wheel is 1m and the final drive ratio is 2 & the gear box ratio is 3 find the torque developed by the engine.

5.   In a simple epicyclic gear train explain how maximum speed reduction and reverse gear can be obtained.
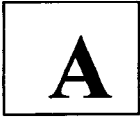
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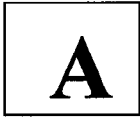
BITS, PILANI-DUBAI, ACADEMIC CITY, DUBAI
SECOND SEMESTER 2008-2009
23-02-09

ME UC441   AUTOMOTIVE MECHANICS
QUIZ 2

DURATION: 25 MINUTES   MAXIMUM MARKS: 5 WEIGHTAGE: 5%

Answer in one or two sentences.

1. Define indicated and brake thermal efficiency of the engine.
2. Differentiate between SFC (specific fuel consumption) and TFC (Total fuel consumption).
3. In an engine measurement the brake power was found to be 7kW and the frictional power was found to be 3kW find the mechanical efficiency of the engine.
4. In a 4 stroke engine measurement it was found out that the air flow rate was 0.25kg /min and the engine speed is 1000rpm. If the swept volume of the engine is 100 cc and the density of air 1kg/m^3 find the volumetric efficiency of the engine.
5. For an engine the brake thermal efficiency was 30% and the mechanical efficiency was 75%. If the air standard efficiency was 50% find the relative efficiency on indicated power basis.

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ME UC441   AUTOMOTIVE MECHANICS
QUIZ 1

DURATION: 25 MINUTES   MAXIMUM MARKS: 10   WEIGHTAGE: 5%

Answer in one or two sentences.

1. How does the adiabatic index and cut off ratio affect the air standard efficiency in case of diesel cycle?
2. What do you mean by dissociation loss in case of fuel air cycles?
3. How does the peak pressure and exhaust gas temperature vary with the fuel air ratio. Draw the corresponding graphs.
4. What do you mean by optimum ignition timing in case of petrol engines?
5. What do you mean by exhaust blow-down? What is the advantage of it?
6. Define ignition lag in petrol engines.
7. How does the compression ratio and inlet pressure affect the knocking in SI engines?
8. How does the delay period vary with respect to injection timing and speed of the engine in case of a diesel engine?
9. Draw the sketch of the Ricardo combustion chamber and list the advantages of Ricardo combustion chamber incase of petrol engines.
10. Name the three indirect injection chambers for CI engines.

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