

BITS PILANI-DUBAI CAMPUS, ACADEMIC CITY.
FIRST SEMESTER 2010-2011
ME C441 AUTOMOTIVE VEHICLES
COMPREHENSIVE EXAMINATION

DATE: 04-01-12

DURATION: 3 Hrs.

MAXIMUM MARKS: 40

WEIGHTAGE: 40%

Answer all the questions

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1. A petrol engine uses a compression ratio of 8 with an air fuel ratio of 15:1. Calorific value of the fuel used is 42mJ/Kg. The pressure and temp at the beginning of the compression is 1 bar and 27°C. Determine the maximum pressure in the cycle taking the index of compression as 1.35. The variation of the specific heat with the temperature can be taken as $C_v = 0.7 + 0.00013T$ where T is in Kelvin. Compare this value with the one obtained considering constant specific heat with $C_v = 0.717$ kJ/kg-K. **4**
 2. Draw the P- θ diagram for a SI engine with three different curves of rate of pressure rise and explain how the rate of pressure rise in an engine combustion chamber influence the peak pressure developed. **4**
 3. Derive an expression for finding the air-fuel ratio supplied by a simple carburetor considering the compressibility of air and neglecting the compressibility of air. **4**
 4. A test on a single cylinder 4 stroke oil engine gave the following results. Brake power = 27kW, Indicated Power = 33kW, fuel consumption = 8 kg/hour, rate of flow of water through gas calorimeter = 12 kg/min, cooling water flow rate = 6kg/min, inlet temp of cooling water = 15°C, outlet temp of cooling water = 75°C, inlet temp of water to exhaust gas calorimeter = 15°C, outlet temp of water to exhaust gas calorimeter = 55°C, exhaust gas temperature = 320°C, outlet temp of exhaust gas from the calorimeter = 80°C, room temperature = 30°C. The fuel has a calorific value 45000 kJ/kg, take specific heat of the exhaust gases, C_{pg} as 1.0035 kJ/kg-K and specific heat of water $C_{pw} = 4.18$ kJ/kg-K. Calculate Indicated thermal efficiency, the Mechanical efficiency and Draw up a heat balance sheet in kW basis. **5**
 5. Discuss briefly the desirable properties of a good lubricant. What is the purpose of additives in lubricating oil? Name the different types of additives used in automobile. **4**
 6. A sliding mesh type of gear box with forward speeds only is to be designed. The gear box should have the following gear ratios available approximately 1, 1.8, 2.9 and 4.2. The centre distance between the lay shaft and the main shaft is 90mm and the clutch shaft pinion gear is to have at least 20 teeth with a diametral pitch of 4.25mm. Calculate the number of teeth of various gears and the exact gear ratios available. **4**
 7. Explain the construction and working of a differential of an automobile with a simple sketch. **3**
 8. With a neat sketch explain the working of master cylinder used in a hydraulic braking system. **3**
 9. A motor car has a wheel base of 3m, the height of its CG above the ground level is 0.7m and it is 1.25m front of the rear axle. If the car is traveling down at the speed of 60km/hr on a slope of 10deg, determine the minimum distance the car may be stopped when a. the rear wheels are only braked, b. only the front wheels are braked, c. all the wheels are braked. The coefficient of friction between the tyre and road may be taken as 0.6 **5**
 10. Derive the condition for true rolling motion in Ackermann steering system. A motor car has a wheel base of 2.743m and king pin pivot center of 1.065m. The wheel track is 1.217m. Calculate the correct angle of outside lock and turning circle radius of the outer front and inner rear wheels when the angle of inside lock is 40deg. **4**

BITS, PILANI-DUBAI, ACADEMIC CITY, DUBAI
FIRST SEMESTER 2011-2012
ME C441 AUTOMOTIVE VEHICLES
TEST 2 (open book) *

DATE: 20-11-11

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

***Only prescribed textbook and hand written notes are allowed**

1. A four-stroke gasoline engine with a swept volume of 5 liters has a volumetric efficiency of 75% when running at 3000 rpm. The engine is fitted with a carburetor, which has a throat diameter of 35mm. Assuming the conditions of a simple carburetor and neglecting the effects of compressibility calculate the pressure and air velocity at the throat. Take the coefficient of discharge at the throat as 0.85 and take the atmospheric conditions as 1 bar and 27°C. Take $R = 0.287$ kJ/kg-K for air. **6**

2. A test on a single cylinder 4 stroke oil engine having bore of 200 mm and stroke of 280 mm gave the following results.

Speed = 300 rpm, brake torque = 350 N-m, IMEP = 7.2 bar, oil consumption = 5 kg/h, coolant flow = 300 kg/h, rise of cooling water temperature = 30°C, air-fuel ratio by weight = 25, exhaust gas temperature = 550°C, room temperature = 25°C. Specific heat of the exhaust gases = 1 kJ/kg-K. Calorific value of the fuel = 45200 kJ/kg. $C_{pw} = 4.187$ kJ/kg-K
Draw up a heat balance sheet in kW basis. **6**

3. What is ZDP? Why it is added with lubricants. What is pour- point of a lubricant? **3**

4. What is the difference between wet sump and dry sump lubrication system? **2**

5. Draw the simple sketches of pintle and pintaux type of nozzles and discuss their merits and demerits. **3**

TEST 1

DATE: 02-10-11

DURATION: 50 MINUTES MAXIMUM MARKS: 25 WEIGHTAGE: 25%
(For the theory questions answer briefly and to the point)

1. Differentiate between the working of actual Diesel cycle and Otto cycle engines with respect to fuel supply, ignition and control of power output. **4**

2. The air fuel ratio of a diesel engine is 29:1. The compression ratio is 16 and the temperature at the end of the compression is 900K. Find at what cylinder volume the combustion is completed. Express this volume as the percentage of stroke volume. Assume the combustion begins at the top dead center and takes place at constant pressure. Take the calorific value of the fuel as 42MJ/kg, $R=0.287\text{kJ/kg-K}$ and $C_v=0.709+0.000028\text{ kJ/kg-K}$. **6**

3. How the spark timing of a SI engine is defined. What is optimum spark timing? Explain this with pressure volume curves for three different spark timings one at TDC, one at well before TDC and one slightly before TDC. **5**

4. For a four stroke petrol engine the spark timing is 30°BTDC . The combustion begins at 15°BTDC . Calculate the ignition delay in milliseconds if the engine runs at 1500rpm. The peak pressure occurs 10° after TDC. If the speed of the engine is increased to 4000rpm, what should be the spark timing so that the peak pressure is attained 10° ATDC as in the previous case? **5**

5. Explain what is knocking in the SI engine and the effects of knocking on the SI engines. Explain the effect of engine parameter on knocking under the heading of Density factors, Time factors and composition factors. Explain the effect of one parameter under each heading. **5**

ME UC441 AUTOMOTIVE VEHICLES
QUIZ 1

DURATION: 20 MINUTES MAXIMUM MARKS: 8 WEIGHTAGE: 8%

Name of the student: -----

Id.: -----

1. What do you mean by knock limited compression ratio in SI engines? What is the range of compression ratio used in the petrol engines for passenger cars?
2. How do the following factors affect the intensity of knocking in the petrol engine?
Cetane number of the fuel, Engine size.
3. Explain the Ricardo combustion chamber for SI engines. List its advantages.
4. Name the four stages of combustion in CI engines.

5. For a four stroke diesel engine the fuel is injected at 50 deg before TDC. The combustion begins 25deg before TDC. The peak pressure occurs at 15deg after TDC and the injection is also stopped at this point. Calculate the combustion duration and injection duration in degrees of crank angle.

6. How does the injection timing and the intake pressure affects the delay period in CI engine.

7. Mention the advantages of direct injection chambers.

8. What do you mean by swirl motion in CI engines? Name the different types of swirl induced in the indirect injection combustion chambers.