BITS PILANI-DUBAI CAMPUS, ACADEMIC CITY.
FIRST SEMESTER 2012-2013
ME C441 AUTOMOTIVE VEHICLES

COMPREHENSIVE EXAMINATION

DATE: 08-01-13

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 6 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 57°C. Determine the maximum pressure in the cycle taking the index of compression as 1.3. The variation of the specific heat with the temperature can be taken as C_v= 0.678+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. **5**

2. 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 two parameters under each heading. **5**

3. 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 , Cpg as 1.0035 kJ/kg-K and specific heat of water Cpw = 4.18 kJ/kg-K. Calculate Indicated thermal efficiency, the Mechanical efficiency and Draw up a heat balance sheet in kW basis. **6**

4. A four cylinder 4S diesel engine develops a power of 180kW at 1500rpm.The BSFC is 0.2kg/kW-hr. At the beginning of the injection, cylinder pressure is 30bar and the maximum cylinder pressure is 50bar.The injection is expected to be at200bar and the maximum pressure at the injector is set to be about 500 bar. Assuming the following, Cd for the injector=0.7, specific gravity of the fuel =0.875, Patm=1 bar and the effective pressure difference is the average pressure difference over the injection period, determine the total orifice area required per injector if the injection takes place over 15 degrees of crank angle. **5**

5. A motor car engine develops 5.9kW at 2100 rpm. Find the suitable size of the clutch plate having friction linings riveted on both sides to transmit the power under the following conditions. Intensity of the pressure not to exceed $6.87*10^4$ Pa, slip torque and losses due to wear is 35% of engine torque, coefficient of friction on contact surface is 0.3 and inside diameter of the friction plate is 0.55 times the outside diameter. **5**

6. With a neat sketch explain the working of master cylinder used in a hydraulic braking system. **4**

7. With a neat diagram explain the construction and working of a simple epicyclic gear train. Explain how different gear ratios are obtained in it. **5**

8. Derive an expression for the stopping distance in meters of a truck equipped with all wheel brakes in terms of μ and speed in km/hour. Calculate the value of μ if the vehicle is stopped in 27.45 m from a speed of 64 km/hr. If the μ is reduced to 0.3 by rain what will be the stopping distance. **5**

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

DATE: 12-12-12

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

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

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1. A simple carburetor has to supply 5kg of air per min. The air is at a pressure of 1.013 bar and at a temperature of 27 C. Calculate the throat diameter of the venturi for the actual air velocity of 91m/sec. Take velocity coefficient to be 0.8. Assume isentropic flow and assume the flow to be compressible. Take C_p=1.005kJ/kg-K, γ=1.4 and R=0.287kJ/kg-K for air. **5**

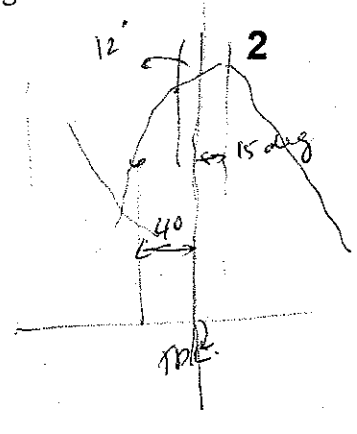
The air fuel ratio of a diesel engine is 29:1. If the compression ratio is 16:1 and the temperature at the end of the compression is 900 K find at what percentage of stroke is the combustion completed. Assume the combustion begins at the top dead center and takes place at constant pressure. Take calorific value of the fuel is 42000kJ/kg, R=0.287 kJ/kg-K and Cv= 0.709+0.000028T kJ/kg-K. **5**

3. In a four stroke diesel engine the fuel is injected 40deg before TDC. The combustion begins 12 deg before TDC. The engine runs at 2500rpm and the fuel injection is stopped at 15deg after TDC. Find out the injection duration in milliseconds. If the speed of the engine is increased to 3200 rpm find out the injection timing so that the peak pressure occurs at the same point as before when the engine speed is 2500 rpm. **4**

4. Clearly explain the difference between the knocking in petrol and diesel engines. **2**

5. Why the actual cycle efficiency is much lower than the air-standard cycle efficiency? List the major losses in an actual engine. **2**

6. Differentiate between physical delay and chemical delay in diesel engine combustion. How does the injection timing affect the delay period in diesel engine. **2**



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BITS, PILANI-DUBAI, ACADEMIC CITY, DUBAI
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ME C441 AUTOMOTIVE VEHICLES

TEST 1

DATE: 24-10-12

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

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1. A motor car weighs 13341.5 N and has a wheel base of 2.65m. The center of gravity of the vehicle is 1.27m behind the front axle and 0.76m above the ground level. Maximum braking on all four wheels on level ground will bring the vehicle uniformly to rest from a speed of 64km/hr in a distance of 25.9m. Calculate the value of adhesion between the tyre and the road. Under the same road condition the vehicle descends from a slope of 1 in 20 and is braked on the front wheels only. Determine the load distributed between the front axle and the rear wheels and the distance required to bring the car to rest. **7**

2. In a simple epicyclic gear train set if the number of teeth on the ring gear (annulus gear) is 180 and the number of teeth on the three planet gears is 60 each and the number of teeth on the sun wheel is 90 **explain how different gear ratios** can be obtained and **find the various gear ratios** (both less than , equal to and greater than 1) which can be obtained with gear set. **4**

3. Explain the construction working and performance of a fluid flywheel. Enumerate the advantages of fluid flywheel over the other types of clutches. **5**

4. In a manual type gear box in which gear besides the neutral does the counter shaft turn without transmitting power? Explain clearly with a simple sketch . **3**

5. With tractive effort, total resistance curves with respect to vehicle speed explain the necessasity of a gearbox. **3**

6. In a sliding mesh type gear box the clutch shaft pinion has 14 teeth and low gear main shaft pinion has 32 teeth. The corresponding lay shaft pinions have 36 and 18 teeth. The final drive ratio is 3.7:1 and the effective radius of the rear tyre is 0.355 m. Calculate the car speed (km/hour) in the above arrangement when the engine speed is 2500 rpm. **3**

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10-10-12

ME UC441 AUTOMOTIVE VEHICLES

QUIZ 1

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

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

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1. Name the different types of brake rotors used in a disc braking system. On what basis brake rotors are designed for vehicle application.

2. Explain the function of a tandem master cylinder in a hydraulic braking system.

3. Calculate the minimum stopping distance of a vehicle travelling at 60km/hr if deceleration of the vehicle equals the acceleration due to gravity.

4. In a fluid flywheel clutch the input shaft speed is 3000 rpm and the output shaft speed is 1000 rpm. Find out the percentage slip.

5. Draw the equilibrium of the vehicle moving upwards when the brakes are applied to all the four wheels and find an expression for the deceleration of the vehicle in terms of gravity, slope angle and the coefficient of friction.

6. A car is running on a level road in third gear (gear ratio 4) with a tractive effort of 1000 N on the driving wheels. If the diameter of the wheel is 0.6m and the final drive ratio is 4.5 find the torque developed by the engine.

7. Draw the simplified diagram of a sliding mesh gear box and explain how the reverse gear is obtained.

8. Explain the steps in double declutching when the gear is changed from say third gear to second gear in case of a constant mesh gear box.