BITS, PILANI-DUBAI , ACADEMIC CITY, DUBAI
SECOND SEMESTER 2009-2010

ME C441 AUTOMOTIVE VEHICLES

COMPREHENSIVE EXAMINATION

DATE: 25-05-10

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

Answer all the questions

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

2. With a cross section of a Jerk type fuel injection pump and diagrams with various plunger positions explain the actual method of controlling the quantity of fuel injected in a CI engine. **4**

3. 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. **5**

4. A 4 cylinder 4 stroke SI engine has compression ratio of 6 to1. A test on the engine gave the following data
Net brake load – 20kg, brake arm-0.5m, imep-6bar, engine speed-2500rpm, fuel consumption-10kg/hour, calorific value of the fuel-45000kJ/kg, cylinder bore - 86mm, stroke-100mm
Calculate i) the mechanical efficiency ii) brake thermal efficiency iii) bmep **5**

5. In a 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. **5**

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

7. What is the need for shock absorber? Explain the working of a hydraulic shock absorber with a neat sketch. **4**

8. Explain the terms castor, camber and kingpin inclination. What are the effects of each on the steering characteristics of a vehicle? **4**

9. 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
SECOND SEMESTER 2008-2009

ME C441 AUTOMOTIVE VEHICLES

TEST 2 (Open Book)*

DATE: 2-05-10

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

*Only prescribed textbook and hand written notes are allowed

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1. With a neat diagram explain the working of a single plate clutch. What is clutch pedal "Free play"? Why is important How is it adjusted in a single plate clutch? **4**

2. A car of total mass of 1500 kg is traveling in a level road in third gear (gear ratio is 2.75) while the engine is running at 6000rpm.Crown wheel to pinion ratio is 4.1, radius of the wheel tyre is 0.3m and frontal area of the car is 2.5 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**

3. In a typical hydromatic transmission system, two planetary gear sets are used in series. The number of teeth in the sun wheel and the ring gear in the first set are 40 and 100 respectively. If the number of teeth in the sun wheel and the ring gear in the second set are 60 and 90, explain how different gear ratios can be obtained and also calculate all the forward gear ratios that can be obtained with this transmission system. **4**

4. List out the differences between a torque coupling and a torque converter **3**

5. What are the drawbacks of a conventional differential? How it is over come in a limited slip differential? **3**

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BITS, PILANI-DUBAI, ACADEMIC CITY, DUBAI
SECOND SEMESTER 2009-2010

ME C441 AUTOMOTIVE VEHICLES

TEST 1

DATE: 21-03-10

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

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1. Show that the efficiency of the Diesel cycle is lower than that of the Otto cycle for the same compression ratio. Comment why the higher efficiency of the Otto cycle compared to the Diesel cycle for the same compression ratio is only of academic interest and no practical importance. **3**

2. Explain by means of suitable graphs the effect of dissociation on maximum temperature and brake power. How does the presence of CO affect dissociation? **5**

3. 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. **6**

4. Explain in detail the phenomenon of Knocking in Diesel engine. Discuss the effects of various engine variables affecting knocking in CI engines. **5**

5. Determine the size of the fuel orifice to give a 13.5:1 air-fuel ratio, if the venturi throat has a 3 cm diameter and the pressure drop in the venturi is 6.5 cm Hg. The air temperature and pressure at carburetor entrance are 1 bar and 27 °C respectively. The fuel orifice is at the same level as that of the float chamber. Take density of gasoline as 740-kg/m^3 and discharge coefficient as unity for both air and fuel. Assume atmospheric pressure to be 76 cm of Hg (1 bar) , Cp = 1000 J/kg-K , R =287 J/kg-K , γ =1.4 for air and consider the compressibility of air **6**

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BITS, PILANI-DUBAI, ACADEMIC CITY, DUBAI
SECOND SEMESTER 2009-2010
14-4-10

ME UC441 AUTOMOTIVE MECHANICS

QUIZ 2

DURATION: 20 MINUTES MAXIMUM MARKS: 7 WEIGHTAGE: 7%

Name - **Id No. -**

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1. What is the use of a helical groove in the jerk type fuel injection pump?

2. Differentiate between the pintle and pintaux nozzles with simple sketches.

3. A six cylinder four stroke diesel engine runs at 2000rpm and produces 100kW. If the brake specific fuel consumption of the engine is 200g/kW-hour.Find the qty of fuel injected per cycle per cylinder in cc if the specific gravity of the fuel is 0.8.

4. In a four stroke petrol engine measurement the brake thermal efficiency is found to be 35% and the mechanical efficiency is found to be 90%. If the compression ratio of the engine is 7 find the relative efficiency of the engine on indicated power basis.

5. In a 4 stroke engine measurement it was found out that the air flow rate was 0.3kg /min and the engine speed is 1500rpm. If the bore and stroke of the engine is 10cm and 12cm respectively and the density of air is $1kg/m^3$ find the volumetric efficiency of the engine.

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BITS, PILANI-DUBAI, ACADEMIC CITY, DUBAI
SECOND SEMESTER 2009-2010
3-3-10
ME UC441 AUTOMOTIVE MECHANICS
QUIZ 1

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

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1. How does the compression and cut off ratio affect the air standard efficiency in case of a dual cycle?

2. Differentiate between the thermodynamic cycle and the open cycle. How do the internal combustion engines operate actually (open cycle or thermodynamic cycle)

3. How does the peak pressure and exhaust gas temperature vary with the fuel air ratio. Draw the corresponding graphs for different compression ratios. .

4. List out the major losses in an actual engine cycle compared to the air standard cycle.

5. How does the cetane number and inlet pressure affect the knocking in SI engines?

6. How does the delay period vary with respect to injection timing and speed of the engine in case of a diesel engine?

7. For a four stroke diesel engine the fuel is injected at 40 deg before TDC. The combustion begins 15deg before TDC. Calculate the delay period in crank angle and in milli seconds if the engine runs at 3000rpm. (2 marks)