**BITS, PILANI-DUBAI, ACADEMIC CITY, DUBAI**
**FIRST SEMESTER 2010-2011**

ME C441 AUTOMOTIVE VEHICLES

# COMPREHENSIVE EXAMINATION

**DATE: 26-12-10**

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

**Answer all the questions**

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1. Explain with suitable graphs, from the point of view of fuel air cycle analysis how fuel air ratio affects indicated thermal efficiency, maximum temperature and pressure in a cycle. **4**

2. Draw the P-θ diagram for a CI engine indicating the various stages of combustion. Indicate also the injection timing, delay period and injection duration in it. **4**

3. 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 100 m/sec.Take velocity coefficient to be 0.8. Assume isentropic flow and assume the flow to be compressible. **6**

4. 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 Indicated thermal efficiency, Draw up a heat balance sheet in kW basis. **6**

5. 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 50 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 are obtained in this system and also calculate all the forward gear ratios that can be obtained with this transmission system. **4**

6. With the help of a neat sketch, explain the construction and operation of a sliding mesh gearbox giving four forward gear ratios with a reverse gear. **4**

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

8. Draw a simple diagram to show the layout of a hydraulically operated four wheel brake system and explain its working in detail. **4**

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 at the speed of 60km/hr on a level track 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 **4**

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## TEST 2 (open book) *

**DATE: 21-11-10**

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

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

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1. With a 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**

2. A four-cylinder gasoline engine operates on the four-stroke cycle. The bore of each cylinder is 80 mm and the stroke is 100 mm. The clearance volume per cylinder is 100cc. At a speed of 4000 rpm the fuel consumption is 20 kg / h and the torque developed is 200 Nm. Calculate
   a. Brake power,
   b. BMEP
   c. Brake thermal efficiency if the calorific value of the fuel is 42000 kJ/kg
   d. Relative efficiency on brake power basis assuming the engine works on the constant volume cycle **6**

3. 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 smallest 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. **6**

4. In a simple epicyclic gear train set if the number of teeth on the ring gear (annulus gear) is 160 and the number of teeth on the three planet gears is 60 each and the number of teeth on the sun wheel is 80 explain how three speed reductions can be obtained (two forward and one reverse) and find the various gear ratios (greater than 1) which can be obtained with gear set. **4**

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# TEST 1

**DATE: 10-10-10**

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

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1. Find the percentage change in the efficiency of an Otto cycle having a compression ratio of 10, if Cv increases by 5%. **5**

2. 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. **4**

3. Why the actual cycle efficiency is much lower than the air-standard cycle efficiency? List the major losses in an actual engine. **4**

4. Define Octane number and the cetane number. Explain the significance of these in SI and CI engine combustion. **6**

5. The venturi of a simple carburetor has a throat diameter of 20 mm and the coefficient of flow is 0.8.The fuel orifice has a diameter of 1.14 mm and coefficient of fuel flow is 0.65. The gasoline surface is 5mm below the throat, neglecting the compressibility of air calculate
   a. the air-fuel ratio for a pressure drop of 0.08 bar when the nozzle tip is neglected.
   b. the air-fuel ratio when the nozzle tip is taken in to account.
   c. the minimum air velocity of air required to start the fuel flow when the nozzle tip is provided.

   Assume the density of air and fuel to be 1.2 kg/m$^3$ and 750 kg/m$^3$ respectively. **6**

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# QUIZ 2

**DURATION: 20 MINUTES** **MAXIMUM MARKS: 10** **WEIGHTAGE: 5%**

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

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1. What is tandem master cylinder? Where is it used?

2. Determine the braking efficiency of the vehicle if the brakes bring the vehicle to rest from 60km/hr in a distance of 15m.

3. Calculate the value of $\mu$ if a truck equipped with all wheel brakes is stopped in 27.45 m from a speed of 64 km/hr.

4. What is helper spring? Where it is employed?

5. Differentiate between conventional and independent suspension system.

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# QUIZ 1

**DURATION: 20 MINUTES** **MAXIMUM MARKS: 10** **WEIGHTAGE: 5%**

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

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1. How does the adiabatic index and cut off ratio affect the air standard efficiency in case of diesel cycle?

2. Find the mass flow rate of air through a carburetor with a throat diameter of 2cm and pressure drop of 0.2 bar at the throat, with the atmospheric condition of 1bar and 300K.Take Cp=1005J/kg-K and R=287J/kg-k. Consider air is incompressible. Take Cd= 0.72 for air.

3. Explain what you mean by exhaust blowdown.

3. For a two stroke diesel engine the fuel is injected at 30 deg before TDC. The combustion begins 15deg before TDC. Calculate the delay period in milli seconds if the engine runs at 3000 rpm.

4. How does the adiabatic index and cut off ratio affect the air standard efficiency in case of diesel cycle?

5. How do the following factors affect the intensity of knocking in the petrol engine?
Cetane number of the fuel, inlet pressure & inlet temp, spark timing and compression ratio.