

COMPREHENSIVE EXAMINATION

DATE: 25-05-11

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

Answer all the questions

1. With suitable graph discuss the effect of spark advance on the performance of Otto cycle engine in view of time loss factor. What is meant by optimum spark advance? **3**
2. Explain how knocking takes place in diesel engines and discuss the various methods of controlling it. Compare the knocking in diesel engines with that of the petrol engines. **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 $\rho_f = 750 \text{ kg/m}^3$. **5**
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 = 350 rpm, brake torque = 390 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 = 500°C , room temperature = 21°C . The fuel has a calorific value 45200 kJ/kg and taking specific heat of the exhaust gases as 1.0035 kJ/kg-K and specific heat of water as 4.18 kJ/kg-K, calculate the Indicated thermal efficiency and draw up a heat balance sheet in kW basis. **5**
5. A car of total mass 1500 kg is traveling in an inclined road with a slope of 40° in second gear (gear ratio = 2.5) while the engine is running at 5000 rpm. Crown wheel to pinion ratio is 4.25. Radius of the wheel tyre is 0.3 m and the frontal area of the car is 2.5 m^2 . Taking the coefficient of rolling friction as 0.2 N/kg and coefficient of wind resistance as $0.06 \text{ N/m}^2 \cdot (\text{km/hour})^2$ determine the power developed by engine to propel the car. **5**
6. With a neat diagram explain the construction and working of a hydro-matic transmission system. Explain how different gear ratios are obtained in it. **5**
7. With a neat diagram explain the working of a single plate clutch. What is clutch free play and how is it set and adjusted in single plate clutch? **4**
8. Explain in detail the construction and working of a leaf spring and show how it is mounted on rear and front axles. Illustrate your answer with simple sketches. **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 30 m from a speed of 100 km/hr. If the μ is reduced by 20% by rain what will be the percentage increase in stopping distance. **5**

ME C441 AUTOMOTIVE VEHICLES
TEST 2 (Open Book)*

DATE: 8-05-11

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

*Only prescribed textbook and hand written notes are allowed

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1. 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 given the indicated mean effective pressure is 8.5 bar and the speed of the engine is 2500 rpm. **5**
 2. A car of total mass of 1600 kg is traveling in a gradient with a slope of 40° in second gear (gear ratio is 4.75) while the engine is running at 5000rpm. Crown wheel to pinion ratio is 4.5:1, radius of the wheel tyre is 0.3m and frontal area of the car is 3 m^2 . Taking the coefficient of the rolling friction as 0.15 N/kg and wind resistance $0.05 \text{ N/m}^2 \cdot (\text{km/h})^2$ determine the power developed by the engine to propel the car. **5**
 3. Explain the construction and working of synchromesh type gear engagement with a sketch and list its advantages **3**
 4. List out the differences between a torque coupling and a torque converter **3**
 5. Draw a simple diagram to show the layout of a hydraulically operated four wheel brake system and explain its working in detail. Explain what you mean by bleeding in hydraulic braking system. **4**

ME C441 AUTOMOTIVE VEHICLES
TEST 1

DATE: 20-03-11

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

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 the effects of **time loss factor** and **heat loss factor** with suitable graphs on the performance of actual I.C. Engines. **5**

3. In a trial on a SI engine at full speed and fully open throttle the ignition timing was 25°BTDC and the ignition delay ended 3°BTDC . Estimate the optimum spark timing for maximum power a. under full throttle conditions when the engine is operated at the half the maximum speed b. when the engine is operated at the half the maximum speed and the throttle is one third open. Assume that the combustion period should finish 15°ATDC for maximum power and the effect of two third closing the throttle at constant speed is to increase the delay period by 20% of the value at the full throttle. **6**

4. Draw a graph and explain the anticipated carburetor performance to fulfill the engine requirement. Explain in detail why rich mixture is required during the idling of an engine. **5**

5. The venturi of a simple carburetor has a throat diameter of 25 mm and the coefficient of flow for air is 0.8. The fuel orifice has a diameter of 1.2 mm and coefficient of fuel flow is 0.65. The gasoline surface is 7mm below the throat, neglecting the compressibility of air calculate
 - a. the air-fuel ratio for a pressure drop of 0.1 bar when the nozzle tip is neglected.
 - b. the air-fuel ratio when the nozzle tip is taken in to account.
 - c. The minimum velocity of air or the critical air velocity 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

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5. _____ serves as the anti oxidant and anti corrosive additive for the lubricant.
6. What is SFC? Differentiate between BSFC and ISFC.
7. Calculate the BMEP for a four cylinder four stroke petrol engine running at 3000rpm and producing 20kW of brake power. The stroke and bore of the cylinder are 10 and 8 cms respectively. **2**
8. Calculate the quantity of fuel injected in cc per stroke per cylinder of a six cylinder four stroke engine if the engine runs at 4500 rpm and the fuel consumption of the engine is measured to be 5kg/hr. Take the density of the fuel to be 700kg/m^3 . **2**

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

07-03-11

ME UC441 AUTOMOTIVE MECHANICS

QUIZ 1

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

1. The specific heat of the gasses varies with temperature. How this variation is calculated in the fuel air cycle?
2. What are the effects of knocking in engines?
3. What are the four stages of combustion in CI engines?
4. How do the inlet temperature and the spark timing affect the knocking in SI engines?

5. What do you mean by exhaust blow down? What are all its effects on the IC engines?
6. 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. (1.5 marks)
7. Calculate the % change air standard efficiency of the Otto cycle if the compression ratio changes from 5 to 8. (1.5 marks).