CODE NO: R09220303 | R09 | SET No - 1

II B.TECH - II SEMESTER EXAMINATIONS, APRIL/MAY, 2011
APPLIED THERMODYNAMICS – I
(MECHANICAL ENGINEERING)

Time: 3hours **Max. Marks: 75**

Answer any FIVE questions
All Questions Carry Equal Marks
- - -

1.a) Derive the equation for efficiency of diesel cycle.
b) A four stroke diesel engine has a bore of 25 cm and stroke of 40 cm. Cut off takes place at 8% of the stroke and initial pressure of the cycle is 0.1 MPa. Calculate the air standard efficiency, m.e.p. and power developed by the engine if it is running at 400 rpm. [7+8]

2.a) With the help of a line diagram, explain the fuel atomizer.
b) Differentiate between indicator diagram and valve timing diagram. [7+8]

3. With all minute details, explain the factors affecting the knocking including the fuel characteristics for S I Engines and C I Engines. [15]

4.a) With the help of diagrams, explain different combustion chambers used in CI engines and advantages of each.
b) What is meant by delay period and explain factors affecting the delay period. [8+7]

5.a) Derive an equation for the work done in single stage reciprocating compressor neglecting the clearance volume.
b) Air at 1 bar and 27^0C is taken into single stage single acting reciprocating air compressor with law of $pv^{1.1}$ = constant to a final pressure of 7 bar and compressor takes 1 m^3/min. Calculate the indicated power and isothermal efficiency. Also calculate the cylinder dimensions and power of the motor required to drive compressor. Speed of compressor is 5 rps. Stroke to bore ratio 1.5:1, η_{mech} = 85%, $\eta_{transmission}$ = 90%. [7+8]

6. A 4 cylinder 4 – stroke petrol engine having bore 6 cm and stroke 10 cm develops 65 N-m torque at 3000 RPM. Find the fuel consumption of the engine in kg/hr and brake mean effective pressure, if the relative efficiency of 50% and clearance volume is 60 cm^3. Take CV = 40 MJ/kg. [15]

7.a) Explain the working details of steady flow rotary compressors and p – v curves of the same.
b) Derive the equation for the thermodynamics cycle work done for a rotary compressor. [8+7]

8. Write short notes:
a) Fuel rating methods.
b) p-θ diagrams in Engine testing.
c) Velocity triangles for axial flow compressor. [15]

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CODE NO: R09220303 | R09 | SET No - 2

II B.TECH - II SEMESTER EXAMINATIONS, APRIL/MAY, 2011
APPLIED THERMODYNAMICS – I
(MECHANICAL ENGINEERING)

Time: 3hours **Max. Marks: 75**

Answer any FIVE questions
All Questions Carry Equal Marks
- - -

1.a) Define mean effective pressure and explain its significance and measurement in an I.C. Engine.
b) A fiat car working on Otto cycle has initial pressure and temperature of 1 bar and 25^0C and pressure at the end of compression is 10 bar. Calculate the percentage clearance and thermal efficiency of the cycle. Also calculate the mean effective pressure if the maximum pressure of the cycle is limited to 20 bar. [7+8]

2.a) Compare and contrast the valve timing diagram and port timing diagram.
b) With the help of a neat diagram, explain the working of fuel injection system. [7+8]

3.a) Explain the methods to control the knocking in SI engines.
b) Explain the significance of Octane number in the rating of SI engine fuels. [7+8]

4.a) What are factors which influence the delay period in CI engines? Explain.
b) What are the requirements of CI engine combustion chamber? Explain why weak mixtures give better efficiency in CI engines? [7+8]

5.a) What is the effect of multistage compression on volumetric efficiency of reciprocating compressor?
b) In single stage single acting air compressor of 30 cm dia, 40 cm stroke makes 100RPM. It takes air at 1 bar and 20^0C to a pressure of 5 bar. Calculate mean effective pressure and power required to drive it when compression is isothermal and adiabatic. [7+8]

6. Following date refers to a four stroke gas engine run for 1hr. RPM = 16,000; Missed cycles = 600; Net brake load = 1.6 KN; Brake circumference = 4 m; mep = 8 bar; Gas consumption = 22KL; CV of gas = 20 KJ/L; d = 25 cm; L = 40 cm; CR = 6.5;
Calculate BP, IP, bsfc, $\eta_{b.th}$ and η_r. [15]

7a) Give the analysis of centrifugal compressors with the help of velocity diagrams.
b) Explain the effect of Pre-whirl in rotary compressors. [8+7]

8. Write short notes on the following:
a) Work done factor in axial flow compressor.
b) Measurement of cylinder pressure.
c) Anti knock additives. [15]

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CODE NO: R09220303 | R09 | SET No - 3

II B.TECH - II SEMESTER EXAMINATIONS, APRIL/MAY, 2011
APPLIED THERMODYNAMICS – I
(MECHANICAL ENGINEERING)

Time: 3hours **Max. Marks: 75**

Answer any FIVE questions
All Questions Carry Equal Marks
- - -

1.a) Why the dual cycle is also called as limited pressure cycle? Compare it with diesel cycle.
b) A diesel engine with a compression ratio of 15 has initial temperature of 295 K and pressure of 0.96 bar. The heat added at constant pressure up to 10% of the strike. Calculate the air standard efficiency of the cycle and indicated power. [7+8]

2.a) What are different methods are adopted in cooling of an I.C. Engine? Explain in detail.
b) Why lubrication system is required in an I.C. Engine and explains one method with the diagram. [7+8]

3.a) What is meant by knocking? Explain the effects of knocking in SI engines.
b) Explain with the help of p-θ diagram, different stages of combustion in SI engines. [7+8]

4.a) What are the different methods used in CI engines to create turbulence in the mixture? Explain its effect on power output and thermal efficiency of the engine.
b) What are the factors which will affect the delay period in CI engines? Explain. [8+7]

5.a) Derive the equation for volumetric efficiency and discuss the effect of clearance on volumetric efficiency.
b) A single stage air compressor is required to deal with 30 m^3 of free air per ht at 1 bar. The delivery pressure at 450 RPM is 6.5 bar. Calculate clearance ratio, the IMEP, BP if the mechanical efficiency is 0.8, isothermal efficiency is 0.76 and volumetric efficiency is 0.75. [7+8]

6. A 6 cylinder, 4-stroke petrol engine consumes 0.4 kg/min fuel when running at 4000RPM. Bore is 8 cm; Stroke is 10 cm. Clearance volume is 65 cm^3. The torque developed = 150 Nm. Calculate BP, BMEP, $\eta_{breakethermal}$ and $\eta_{relative}$. CV = 40 MJ/Kg. [15]

7.a) Draw the velocity triangles and give the analysis of axial flow compressors.
b) Explain the significance of Degree of Reaction in axial flow compressors. [8+7]

8. Write short notes:
a) Exhaust blow down.
b) Detonation and its effects.
c) Heat balance sheet – importance. [15]

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CODE NO: R09220303 | R09 | SET No - 4

II B.TECH - II SEMESTER EXAMINATIONS, APRIL/MAY, 2011
APPLIED THERMODYNAMICS – I
(MECHANICAL ENGINEERING)

Time: 3hours **Max. Marks: 75**

Answer any FIVE questions
All Questions Carry Equal Marks
- - -

1.a) Compare Otto, diesel and dual cycles for same maximum pressure and heat input condition.
b) The temperature of air at the beginning and end of compression of an Otto cycle are 310K and 600K. Calculate air standard efficiency of the cycle if engine develops 20Kw indicated thermal efficiency and relative efficiency. CV = 44MJ/Kg; Sp.gravity = 0.78. [7+8]

2.a) Differentiate between air standard cycle and fuel air cycle. What assumptions are made in analyzing fuel air cycle?
b) Explain with the help of line diagram the working of a simple carburetor. [8+7]

3.a) What is meant by ignition lag in SI engines and explain the factors affecting the ignition lag.
b) Explain what is meant by abnormal combustion and knocking in SI engines in detail. [8+7]

4.a) What is the effect of injection timing and rate of fuel injection on diesel knock?
b) Define swirl, squish, directional movement and turbulence in CI engine. Explain their significance in the design of CI engine combustion chambers. [7+8]

5.a) What is the condition for maximum efficiency in multistage compression.
b) A single stage double acting air compressor running at 5RPS delivers air at 7 bar from 1 bar and 27^0C. The amount of free air delivered is 0.15 m^3/s. If the clearance volume is 5% of swept volume and index of expansion/compression is 1.3. Calculate the volumetric efficiency, indicated power and cylinder dimensions if L/D ratio as 1.2. [7+8]

6. A two stroke diesel engine was motored when meter reading was 1.5 kW. Then the test on the engine was carried with following results:
Brake torque = 120 N-m, RPM = 600; fuel used = 2.5 kg, CV of fuel = 41 kJ/kg; cooling water used = 820 kg. Rise in cooling water temperature is 100^0 C. Exhaust gas temp = 350^0C; Room temp = 25^0C; A:F = 32:1; Calculate BP, IP, Mechanical and indicated thermal efficiencies and heat balances on percentage basis. [15]

7.a) Derive the equation for polytropic efficiency for a multi stage rotary compression.
b) Derive the equation for energy transfer between fluid and rotor of rotary compressor. [7+8]

8. Write short notes:
a) Work done factor- significance in axial compressor.
b) Determination of FP.
c) Detonation and its effects. [15]

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