Code No: 07A4EC05 **R07** **Set No. 2**

II B.Tech II Semester Examinations,April/May 2012
THERMAL ENGINEERING - I
Common to Mechanical Engineering, Automobile Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Explain the different types of nozzles used in CI engines? [16]

2. A gas engine having a cylinder 250mm bore and 450mm stroke has a volumetric efficiency of 80%. Air-gas ratio equals 9:1, calorific value of fuel 21,000 Kj/ m^3 at NTP. Calculate the heat supplied to the engine per working cycle. If the compression ratio is 5:1, what is the heat value of the mixture per working stroke per m^3 of total cylinder volume? [16]

3. Why is the actual cycle-efficiency much lower than the air-standard cycle efficiency? List the major losses and differences in actual engine and air-standard cycles. [16]

4. (a) Derive the equation for work required for a single stage reciprocating air compressor.
   (b) A double acting air compressor works with an indicated power of 37 kW. Air is drawn in at 1 bar, 300 K and compressed according to the law $pv^{1.2}$ = constant to 7 bar. The compressor runs at 200 rpm with average piston speed of 2.5 m/s. By neglecting the clearance, calculate the dimensions of the cylinder. [8+8]

5. A six-cylinder four-stroke, direct-injection oil engine is to deliver 120 kW at 1600 rpm. The fuel to be used has a calorific value of 43 MJ/kg and its percentage composition by mass is carbon 86%, hydrogen13%, and non combustibles 1%. The absolute volumetric efficiency is assumed to 80%, the indicated thermal efficiency 40% and the mechanical efficiency 80%. The air consumption to be 110% in excess of that required for theoretically correct combustion.
   (a) Estimate the volumetric composition of dry exhaust gas.
   (b) Determine the bore and stroke of the engine, taking a stroke to bore ratio as 1.5. Assume the volume of 1 kg of air at the given conditions as $0.77m^3$. [16]

6. (a) What are problems generally faced in S.I .Engine combustion chamber? Suggest suitable methods to rectify the problems?
   (b) What are different auxiliary components required in S.I. Engine for achieving better combustion? [8+8]

7. (a) What are the advantages and limitations of axial flow compressor over other dynamic compressors?
   (b) Draw the T-S diagram for the process occurring in axial flow compressor and explain the salient points. [8+8]

8. Determine the absolute Mach number of the flow at the exit of a radial vaned impeller of a centrifugal compressor when the radial component of the velocity at the impeller exit is 28 m/s and the slip factor is 0.9. The impeller tip speed is 350 m/s. If the impeller area is 0.08 m^2 and the total head isentropic efficiency is 90%, determine mass flow rate. Assume atmospheric condition is 288 K and 1 bar. [16]

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Code No: 07A4EC05 **R07** **Set No. 4**

II B.Tech II Semester Examinations,April/May 2012
THERMAL ENGINEERING - I
Common to Mechanical Engineering, Automobile Engineering
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive the equation for work required for a single stage reciprocating air compressor.
   (b) A double acting air compressor works with an indicated power of 37 kW. Air is drawn in at 1 bar, 300 K and compressed according to the law $pv^{1.2}$ = constant to 7 bar. The compressor runs at 200 rpm with average piston speed of 2.5 m/s. By neglecting the clearance, calculate the dimensions of the cylinder. [8+8]

2. Explain the different types of nozzles used in CI engines? [16]

3. (a) What are the advantages and limitations of axial flow compressor over other dynamic compressors?
   (b) Draw the T-S diagram for the process occurring in axial flow compressor and explain the salient points. [8+8]

4. (a) What are problems generally faced in S.I .Engine combustion chamber? Suggest suitable methods to rectify the problems?
   (b) What are different auxiliary components required in S.I. Engine for achieving better combustion? [8+8]

5. Why is the actual cycle-efficiency much lower than the air-standard cycle efficiency? List the major losses and differences in actual engine and air-standard cycles. [16]

6. A gas engine having a cylinder 250mm bore and 450mm stroke has a volumetric efficiency of 80%. Air-gas ratio equals 9:1, calorific value of fuel 21,000 Kj/ m^3 at NTP. Calculate the heat supplied to the engine per working cycle. If the compression ratio is 5:1, what is the heat value of the mixture per working stroke per m^3 of total cylinder volume? [16]

7. A six-cylinder four-stroke, direct-injection oil engine is to deliver 120 kW at 1600 rpm. The fuel to be used has a calorific value of 43 MJ/kg and its percentage composition by mass is carbon 86%, hydrogen13%, and non combustibles 1%. The absolute volumetric efficiency is assumed to 80%, the indicated thermal efficiency 40% and the mechanical efficiency 80%. The air consumption to be 110% in excess of that required for theoretically correct combustion.
   (a) Estimate the volumetric composition of dry exhaust gas.
   (b) Determine the bore and stroke of the engine, taking a stroke to bore ratio as 1.5. Assume the volume of 1 kg of air at the given conditions as 0.77m^3. [16]

8. Determine the absolute Mach number of the flow at the exit of a radial vaned impeller of a centrifugal compressor when the radial component of the velocity at the impeller exit is 28 m/s and the slip factor is 0.9. The impeller tip speed is 350 m/s. If the impeller area is 0.08 m^2 and the total head isentropic efficiency is 90%, determine mass flow rate. Assume atmospheric condition is 288 K and 1 bar. [16]

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Code No: 07A4EC05 **R07** **Set No. 1**

II B.Tech II Semester Examinations,April/May 2012
THERMAL ENGINEERING - I
Common to Mechanical Engineering, Automobile Engineering
Time: 3 hours **Max Marks: 80**
Answer any FIVE Questions
All Questions carry equal marks
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1. Determine the absolute Mach number of the flow at the exit of a radial vaned impeller of a centrifugal compressor when the radial component of the velocity at the impeller exit is 28 m/s and the slip factor is 0.9. The impeller tip speed is 350 m/s. If the impeller area is 0.08 m^2 and the total head isentropic efficiency is 90%, determine mass flow rate. Assume atmospheric condition is 288 K and 1 bar. [16]

2. (a) Derive the equation for work required for a single stage reciprocating air compressor.
   (b) A double acting air compressor works with an indicated power of 37 kW. Air is drawn in at 1 bar,300 K and compressed according to the law $pv^{1.2}$ = constant to 7 bar. The compressor runs at 200 rpm with average piston speed of 2.5 m/s. By neglecting the clearance, calculate the dimensions of the cylinder. [8+8]

3. A gas engine having a cylinder 250mm bore and 450mm stroke has a volumetric efficiency of 80%. Air-gas ratio equals 9:1, calorific value of fuel 21,000 Kj/ m^3 at NTP. Calculate the heat supplied to the engine per working cycle. If the compression ratio is 5:1, what is the heat value of the mixture per working stroke per m^3 of total cylinder volume? [16]

4. (a) What are problems generally faced in S.I .Engine combustion chamber? Suggest suitable methods to rectify the problems?
   (b) What are different auxiliary components required in S.I. Engine for achieving better combustion? [8+8]

5. Explain the different types of nozzles used in CI engines? [16]

6. (a) What are the advantages and limitations of axial flow compressor over other dynamic compressors?
   (b) Draw the T-S diagram for the process occurring in axial flow compressor and explain the salient points. [8+8]

7. A six-cylinder four-stroke, direct-injection oil engine is to deliver 120 kW at 1600 rpm. The fuel to be used has a calorific value of 43 MJ/kg and its percentage composition by mass is carbon 86%, hydrogen13%, and non combustibles 1%. The absolute volumetric efficiency is assumed to 80%, the indicated thermal efficiency 40% and the mechanical efficiency 80%. The air consumption to be 110% in excess of that required for theoretically correct combustion.

(a) Estimate the volumetric composition of dry exhaust gas.

(b) Determine the bore and stroke of the engine, taking a stroke to bore ratio as 1.5. Assume the volume of 1 kg of air at the given conditions as $0.77m^3$. [16]

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Code No: 07A4EC05 **R07** **Set No. 3**

II B.Tech II Semester Examinations,April/May 2012
THERMAL ENGINEERING - I
Common to Mechanical Engineering, Automobile Engineering
Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A six-cylinder four-stroke, direct-injection oil engine is to deliver 120 kW at 1600 rpm. The fuel to be used has a calorific value of 43 MJ/kg and its percentage composition by mass is carbon 86%, hydrogen13%, and non combustibles 1%. The absolute volumetric efficiency is assumed to 80%, the indicated thermal efficiency 40% and the mechanical efficiency 80%. The air consumption to be 110% in excess of that required for theoretically correct combustion.
   (a) Estimate the volumetric composition of dry exhaust gas.
   (b) Determine the bore and stroke of the engine, taking a stroke to bore ratio as 1.5. Assume the volume of 1 kg of air at the given conditions as $0.77m^3$. [16]

2. Determine the absolute Mach number of the flow at the exit of a radial vaned impeller of a centrifugal compressor when the radial component of the velocity at the impeller exit is 28 m/s and the slip factor is 0.9. The impeller tip speed is 350 m/s. If the impeller area is 0.08 m^2 and the total head isentropic efficiency is 90%, determine mass flow rate. Assume atmospheric condition is 288 K and 1 bar. [16]

3. Explain the different types of nozzles used in CI engines? [16]

4. (a) What are the advantages and limitations of axial flow compressor over other dynamic compressors?
   (b) Draw the T-S diagram for the process occurring in axial flow compressor and explain the salient points. [8+8]

5. (a) What are problems generally faced in S.I .Engine combustion chamber? Suggest suitable methods to rectify the problems?
   (b) What are different auxiliary components required in S.I. Engine for achieving better combustion? [8+8]

6. Why is the actual cycle-efficiency much lower than the air-standard cycle efficiency? List the major losses and differences in actual engine and air-standard cycles. [16]

7. (a) Derive the equation for work required for a single stage reciprocating air compressor.
   (b) A double acting air compressor works with an indicated power of 37 kW. Air is drawn in at 1 bar,300 K and compressed according to the law $pv^{1.2}$ = constant to 7 bar. The compressor runs at 200 rpm with average piston speed of 2.5 m/s. By neglecting the clearance, calculate the dimensions of the cylinder. [8+8]

8. A gas engine having a cylinder 250mm bore and 450mm stroke has a volumetric efficiency of 80%. Air-gas ratio equals 9:1, calorific value of fuel 21,000 Kj/ m^3 at NTP. Calculate the heat supplied to the engine per working cycle. If the compression ratio is 5:1, what is the heat value of the mixture per working stroke per m^3 of total cylinder volume? [16]

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