CODE NO: R09220303 | R09 | SET No - 1

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

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

Answer any FIVE questions
All Questions Carry Equal Marks

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1.a) Briefly explain the effect of the compression ratio on the thermal efficiency of Otto cycle.
b) What are different factors that differentiate the actual Diesel cycle from that of ideal cycle? [7+8]

2.a) What is the function of a Carburetor and what are the engine air-fuel ratio requirements?
b) What are the requirements of fuel injection system for CI engines? What are the differences between air less and air injection of fuel in CI engines? [7+8]

3.a) Briefly explain different stages of combustion in SI engines with the help of Pressure Vs crank angle diagram.
b) What is the effect of the following parameters on the ignition delay of SI engine combustion?
i) Nature of air-fuel ratio ii) Speed iii) Temperature of the gas [7+8]

4.a) With the help of a simple schematic diagram, explain the working of a turbulence combustion chamber of CI engine. What are its advantages compared to other type of combustion chambers.
b) What are the important qualities of CI engine fuels? [8+7]

5.a) What is the function of a dynamo meter? Give the classification of dynamo meter.
b) Design bore and stroke of 4s petrol engine for the following data:
Brake Power = 73.5 kW
Speed = 400 RPM
Brake MEP = 8.5 bar
Mechanical efficiency = 80%
Brake SFC = 0.346 kg/kWh
Calorific value = 44100 kJ/kg
Compression ratio = 6
Also calculate indicated power, BP air standard and relative efficiency and indicated MEP. Assume that bore is equal to stroke. [7+8]

6. A single acting reciprocating compressor having 8 cm bore and 10 cm stroke compresses air from 1 bar to a delivery pressure of 6 bar. The compressed gas is stored in a receiver having a capacity of 1.2 m^3. The speed of the compressor is 500 RPM and consumes 1.175 kW brake power. The indicated mean effective pressure is 2.24 bar. The initial conditions in the reservoir were 1 bar and 15^0C. After 2 minutes of pumping the pressure rise in the receiver is 6 bar at 52^0C. Find
i) Free air delivered per minute at 15^0C
ii) Volumetric efficiency
iii) Mechanical and isothermal efficiencies. [15]

7.a) Give the classification of compressors based on the principle of operation.
b) Discuss the effect of compressor geometry on the compression efficiency of centrifugal compressor. [7+8]

8.a) Discuss various losses in an axial flow compressor stage.
b) Give the comparison between reciprocating and axial flow compressors based on various factors. [7+8]

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APPLIED THERMODYNAMICS – I
(AUTOMOBILE ENGINEERING)

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

Answer any FIVE questions
All Questions Carry Equal Marks

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1.a) Discuss the deviations of actual Otto cycle from that of ideal.
b) In an air standard Diesel cycle, the compression ratio is 15 and the pressure and temperature at the beginning of compression are 1.04 bar and 15^0C. The maximum temperature of the cycle is 2330 K. Determine the thermal efficiency and the mean effective pressure. [7+8]

2. What are the elements of the complete carburetor system? Explain the function of each in detail. [15]

3.a) What are the different variables affecting the knock in SI engines ?
b) Briefly explain different methods to reduce detonation in SI engines. [7+8]

4.a) Explain the effect of inlet temperature and pressure, engine speed, engine size, injection pressure and chemical composition of fuel on Diesel knock.
b) With the help of simple schematic, explain the working of different types of direct combustion chambers of CI engines [7+8]

5.a) What is the use of Morse test on multi cylinder engines? Briefly explain.
b) During the testing of a 4s oil engine fitted with a simple rope brake dynamo meter, the following readings were taken.

Brake wheel diameter = 60 cm
Brake rope diameter = 2.5 cm
Dead load on the brake = 200 N
Spring balance reading = 50 N
Speed = 450 RPM
Area of indicator diagram = 4.2 cm^2
Length of the indicator diagram = 6 cm
Spring constant = 6 bar/ cm
Bore = 10 cm
Stroke = 15 cm
Brake SFC = 0.3 kg/kWh
Calorific value = 43960 kJ/kg

Determine the brake power, mechanical efficiency and indicated thermal efficiency. [15]

6. The free air delivered by a single stage double acting air compressor measured at 1.013 bar and 15^0C is 14 m^3/min. The pressure and temperature of the cylinder during induction are 0.95 bar and 32^0C. The delivery pressure is 7 bar and the index of compression and expansion are 1.3. If the clearance volume is 5% of the swept volume, calculate indicated power, delivery temperature and volumetric efficiency. [15]

7.a) What are the different losses in case of a centrifugal compressor?
b) With the help of neat schematic, explain the working of a roots blower and its mechanical details. [7+8]

8.a) Derive the expression for work done in a typical axial flow compressor stage with the help of velocity triangles.
b) Briefly explain the phenomenon of surging in axial flow compressors. [8+7]

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CODE NO: R09220303 | R09 | SET No - 3

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

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

Answer any FIVE questions
All Questions Carry Equal Marks
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1.a) Briefly explain the effect of dissociation of gas on the performance of the Otto cycle with the help of p-V diagram.
b) An engine operates on ideal Diesel cycle with a compression ratio of 12 and the fuel is injected for 10% of the stroke. The pressure of the air entering the cylinder is 0.98 bar and the temperature is 15^0C. Calculate the cut off ratio, temperature at the end of the compression process and the heat input. [7+8]

2.a) With the help of a simple schematic diagram, explain the working of a magneto ignition system.
b) What are the requirements of an ignition system in SI engines? [8+7]

3.a) What are the effects of knock on the performance of SI engines ?
b) Differentiate between normal and abnormal combustion with the help of flame propagation diagram and Pressure Vs crank angle diagram in SI engines. [7+8]

4.a) Explain why and how knock occurs in CI engines. Compare the phenomena of knock in SI and CI engines with the help of pressure Vs crank angle diagram.
b) Explain the effect of following parameters on the delay period in Diesel knock:
i) Compression ratio ii) injection timing iii) fuel volatility. [7+8]

5.a) What are the factors that affect the volumetric efficiency of an IC engine?
b) A four cylinder, 4s petrol engine has 7.5 cm bore and 10.5 cm stroke. The clearance volume in each cylinder is $1/7^{th}$ of the swept volume. The speed of the engine measured by a Tachometer is 2000 RPM and the torque at this speed is 70 N. The fuel consumption is 4.5 kg/h. Assuming brake efficiency ratio based on air standard cycle is 60, calculate brake mep and calorific value of the fuel. If the engine has a mechanical efficiency of 80%, calculate the indicated thermal and relative efficiency. [7+8]

6. A 23 kW electric motor drives a single cylinder, single acting air compressor running at 300 RPM. The mechanical efficiency is 87%. The air inlet conditions are 1.013 bar and 15^0C and the delivery pressure is 8 bar. Assuming that the index of compression and expansion is n = 1, clearance volume is 7% of the swept volume and L = D, calculate the free air delivery in m^3/min, volumetric efficiency and the dimensions of the compressor. [15]

7.a) How the rotary compressors are different from reciprocating compressors? Compare.
b) Derive the expression for work supplied to the gas in a stage of a centrifugal compressor with the help of velocity triangles. [8+7]

8.a) Explain the phenomenon of surging in stage of an axial flow compressor.
b) Discuss various losses in an axial flow compressor stage in detail. [8+7]

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CODE NO: R09220303 | R09 | SET No - 4

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

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

Answer any FIVE questions
All Questions Carry Equal Marks
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1.a) The swept volume of four cylinder petrol engine is 2000 cm^3. The clearance volume of each cylinder is 60 cm^3. Determine the air standard thermal efficiency. If the inlet conditions are 1 bar and 24^0C, and the maximum cycle temperature is 1400^0C, determine the mean effective pressure.
b) Briefly explain the effect of heat losses, blow down losses and pumping losses on the performance of the Otto cycle. [8+7]

2.a) In case of SI engine or CI engine, give the reason for the size of suction valve being greater than that of delivery.
b) Describe the principle of working of a simple carburetor and mention its defects. [8+7]

3.a) What is the effect of engine variables on the flame speed?
b) What are the requirements of combustion chambers for the better performance of SI engines? Explain briefly. [7+8]

4. What are the different stages of combustion in CI engines? Explain in detail with the help of pressure Vs crank angle diagram. [15]

5.a) What are the different methods employed to find the indicated power of IC engines without using indicator?
b) During the testing of a single cylinder 4s oil engine fitted with a simple rope brake dynamo meter, the following readings were taken.

Brake wheel diameter = 65 cm
Brake rope diameter = 3 cm
Dead load on the brake = 270 N
Spring balance reading = 40 N
Speed = 450 RPM
Area of indicator diagram = 4.2 cm^2
Length of the indicator diagram = 6.5 cm
Spring constant = 12 bar/ cm
Bore = 11 cm
Stroke = 16 cm
Brake SFC = 0.3129 kg/kWh
Calorific value = 41868 kJ/kg

Determine the brake power, indicated power, mechanical efficiency and indicated and brake thermal efficiency [7+8]

6. A single acting reciprocating compressor having 8 cm bore and 10 cm stroke compresses air from 1 bar to a delivery pressure of 6 bar. The compressed gas is stored in a receiver having a capacity of 1.2 m^3. The speed of the compressor is 500 RPM and consumes 1.175 kW brake power. The indicated mean effective pressure is 2.24 bar. The initial conditions in the reservoir were 1 bar and 15^0C. After 2 minutes of pumping the pressure rise in the receiver is 6 bar at 52^0C. Find
i) Free air delivered per minute at 15^0C
ii) Volumetric efficiency
iii) Mechanical and isothermal efficiencies. [15]

7.a) Discuss the influence of impeller blade shape on the performance of a centrifugal compressor.

b) With the help of a neat schematic, explain the working of a vane sealed compressor and give its applications. [7+8]

8.a) Enumerate the fields of applications of compressors in general and axial flow compressors in particular.

b) Explain the phenomena of stalling and choking in axial flow compressors. [8+7]

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