Code No: R09220303 | R09 | SET-1

B.Tech II Year - II Semester Examinations, April-May, 2012
APPLIED THERMODYNAMICS – I
(Common to Mechanical Engineering, Automobile Engineering)

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

Answer any five questions
All questions carry equal marks

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1.a) Explain in detail fuel air cycle of CI engine.
b) In an ideal diesel cycle the temperatures at the beginning and end of compression are 27^0C and 600^0C respectively. The temperatures at the beginning and end of expansion are 1900^0C and 850^0C respectively. Calculate compression ratio, cut off ratio and ideal efficiency of the cycle. [15]

2.a) Explain the significance of VTD and PTD and explain valve overlap period in detail for SI engines.
b) Explain the processes like cooling and lubrication processes in CI engines with the help of line diagrams. [15]

3.a) With the help of neat diagram, explain the method of swirl generation by helical inlet port in CI engines.
b) With the help of P-θ diagram, explain four stages of combustion in CI engine. [15]

4.a) Explain what is meant by knocking in SI engines and what are anti knock additives and their significance.
b) Explain different shapes of combustion chambers which are mostly used with the help of line diagram and explain them in detail. [15]

5.a) Explain the methods of measurement of frictional power.
b) A 4 cylinder, 2 stroke petrol engine develops 40KW at 40RPS. The m.e.p. on each piston is 8 bar and the mechanical efficiency is 80%. Calculate the diameter and stroke of each cylinder if stroke to bore ratio is 1.5. Calculate BSFC if brake thermal efficiency is 24%. CV of fuel is 44 MJ/Kg. [15]

6. An axial compressor has a mean diameter of 60m and runs at 15,000 RPM. If the actual temperature rise and pressure ratio developed are 30^0C and 1.3 respectively, calculate the power required to drive the compressor while delivering 57 Kg/Sec of air. Assuming mechanical efficiency of 86% and initial temperature of 35^0C, calculate the stage efficiency and the degree of reaction if the temperature at the rotor exit is 55^0C. [15]

7.a) Draw a Centrifugal compressor in side view and end view showing all critical components and give salient working details.
b) Briefly explain the effect of each impeller vane on the performance of centrifugal compressor. [15]

8. Write short notes on the following
a) Minimum work condition for reciprocating stage compression.
b) Zenith Carburetor.
c) Detonation and Knocking. [15]

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Code No: R09220303 | R09 | SET-2

B.Tech II Year - II Semester Examinations, April-May, 2012
APPLIED THERMODYNAMICS – I
(Common to Mechanical Engineering, Automobile Engineering)

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

Answer any five questions
All questions carry equal marks

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1.a) Compare Air standard cycle and actual cycles. Explain what are the reasons for deviation and why?
b) Derive the equation for thermal efficiency and m.e.p. for Otto cycle and compare the values with diesel cycle. [15]

2.a) Draw the line diagram and explain the functioning of any latest carburetor.
b) What are the methods adopted for fuel injection systems for diesel engines? Explain one of them in detail. What is meant by CRDI engine? Explain the details. [15]

3.a) Explain the mechanism of ignition advance mechanism and optimum spark timing in SI engines?
b) Give a schematic sketch of electrical ignition system of a modern automobile engine and explain in detail. [15]

4.a) What is meant by diesel knock and how to control it? Explain with the help of examples.
b) What are the different shapes of nozzles and different combustion chambers of CI engines and explain them with diagrams in detail. [15]

5.a) Explain the methods of measurement of indicated power.
b) A four cylinder engine running at 20RPS gave 19KW of brake power. The average torque when one cylinder was cut off was 103 N-m. Calculate Indicated thermal efficiency if CV = 42,000 KJ/Kg and engine uses 0.34 Kg of petrol per KWhr of brake power. [15]

6. A single sided centrifugal compressor is to deliver 15 Kg/sec of air when operating at a stagnation pressure ratio of 4:1 and a speed of 200 RPS. The inlet stagnation conditions may be taken as 1 bar and 288K. Assuming a slip factor of 0.9, a power input factor of 1.04 and an overall isentropic efficiency of 0.8, estimate the overall diameter of the impeller. [15]

7.a) Describe Surging and stalling in compressors. Show the performance characteristic of a typical compressor indicating stable operating conditions as a function of speed.
b) What is meant by cascading and why is cascade testing done? [15]

8. Write short notes on the following
a) Fan, Blower, Compressor – Compare and Contrast.
b) Exhaust blow down and its effects.
c) Vane sealed compressor working details. [15]

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Code No: R09220303 | R09 | SET-3

B.Tech II Year - II Semester Examinations, April-May, 2012
APPLIED THERMODYNAMICS – I
(Common to Mechanical Engineering, Automobile Engineering)

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

Answer any five questions
All questions carry equal marks

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1.a) What are different losses incurred in C I Engine in order to understand actual cycle? Explain the salient points.
b) What are the important requirements of fuel injection system in a C.I Engine? Explain with suitable diagram. [15]

2.a) Draw the schematic diagram of simple carburetor and explain its working principle and also discuss how to achieve rich mixture during peak loads and ideal conditions.
b) How does dry sump lubrication system is different from wet sump lubrication system? [15]

3.a) What is ignition lag in S.I. Engine combustion? Explain the influence of different operating parameters on ignition lag.
b) What is pre-ignition? Discuss its ill effects on performance. [15]

4.a) Explain the influence of different operating parameters on ignition delay during combustion process in C.I. Engine.
b) Describe the phenomenon of knocking in C.I. Engine and how it is different from S.I. Engine detonation. [15]

5. In a test on two stroke oil engine, the following results were obtained: speed = 350 rev/min; Net brake load = 600 N; Mean effective pressure = 2.66 bar; Fuel consumption = 3.2 kg/h; cooling water used = 495 kg/h; Temperatures of jacket water at inlet and outlet = 30^0C and 50^0C; Exhaust gases per kg of fuel = 32 kg; Temperature of exhaust gases = 432^0C; specific heat of exhaust gases = 1.005 kJ/kg K; Inlet air temperature = 32^0C. Draw up a heat balance for the engine if its cylinder diameter = 205 mm and stroke = 275 mm; brake drum diameter = 1.0 m; calorific value of fuel = 40870 kJ/kg. [15]

6.a) Derive the equation for work required in each stage of two stage compression with perfect inter cooling and discuss the work saving due to two stage compression on P-V diagram.
b) Find the power required to compress 25 m^3/h of air at 101.3 kPa, 20^0C to a pressure ratio of 7 in LP cylinder, cooled at constant pressure to 25^0C in an inter cooler, then again compressed in HP cylinder to a pressure ratio of 6.0. [15]

7.a) A rotary air compressor receives air at a pressure of 1 bar and 17^oC and delivers at a pressure of 6 bar. Determine work done by compressor per kg of air delivered, if process
i) isothermal ii) adiabatic iii) polytropic with the index as 1.3.
b) Define slip factor and power input factor of a centrifugal compressor. How does these influence the performance of the pump? [15]

8.a) Draw the velocity triangles for the axial flow air compressor and discuss the method to calculate the power requirement.

b) An axial flow compressor with compression ratio as 5, draws air at 20^{o}Cdelivers it at 50^{o}C. Assuming 50% degree of reaction, find the velocity of flow if the blade velocity is 100 m/s. Also find the number of stages if work factor = 0.85, $\alpha = 10^{o}$, $\beta = 40^{o}$ and C_p = 1.005 kJ/kg K. [15]

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Code No: R09220303 | R09 | SET-4

B.Tech II Year - II Semester Examinations, April-May, 2012
APPLIED THERMODYNAMICS – I
(Common to Mechanical Engineering, Automobile Engineering)

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

Answer any five questions
All questions carry equal marks

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1.a) How does the variation of specific heats and dissociation exhaust gases influence the cycle performance?
b) Draw the diagram of fuel pump used for C I Engine and explain the important functions of the components. [15]

2.a) How does the valve timing diagram influence the volumetric efficiency of I C Engine? Discuss the salient features.
b) In what respect working of an actual engine differ from theoretical cycle. [15]

3.a) Name few additives, which can minimize the knocking in S.I. Engine and What are detrimental effects on cylinder by adding additives in S.I. Engine.
b) What are the requirements for better combustion chamber of S I Engine? Explain them. [15]

4.a) Draw the p-θ diagram of the C.I. Engine combustion and explain different stages of combustion process.
b) Explain the advantages and limitations of direct injection type combustion chambers over indirect injection type combustion chambers of C.I. Engine. [15]

5. A four stroke petrol engine with a compression ratio of 6.5 to 1 and total piston displacement of 5.2×10^{-3} m^3 develops 100 kW brake power and consumes 33kg of petrol per hour of calorific value 44300 kJ/kg at 3000 rpm. Find:
i) Brake mean effective pressure
ii) Brake thermal efficiency
iii) Air standard efficiency ($\gamma = 1.4$); and iv) Air-fuel ratio by mass.
Assume a volumetric efficiency of 80 %. One kg of petrol vapour occupies 0.26 m^3 at 1.013 bar and 15^0C. Take R for air 287 J/kg K. [15]

6.a) Show that in a reciprocating compressor with perfect inter cooling, the work required in LP compressor is same as that of work required in HP compressor.
b) A single stage reciprocating air compressor compresses 10 kg/min of air from 100 kPa, 17^0C to 600 kPa according to the law $pV^{1.25}$ = constant. If the diameter of the cylinder is 0.3 m and the average piston speed is 150 m/min at 100 rpm, determine the power required to drive the compressor. [15]

7.a) What are different losses occurring in the centrifugal compressor due to different blade shapes? Explain.
b) A centrifugal air compressor having the internal and external diameters of 250 mm and 500 mm respectively compresses 30 kg of air per minute while running at 4000 rpm. The vane angles at inlet and outlet are 30^o and 40^o respectively. Find the necessary thickness of the blade, if the impeller contains 40 blades. Take specific volume air as 0.8 m^3/kg. [15]

8.a) Describe the working principle of axial flow air compressor with suitable diagram and velocity triangles.

b) The following data refers to an axial flow air compressor: turning angle = 30^o; increment velocity I = 100 m/s; degree of reaction = 0.5 speed = 36000 rpm; mean blade diameter = 140 mm; inlet pressure and temperature 2 bar and 57^oC respectively. Find the other angles, pressure rise, the amount of air handled and power if the blade height is 20 mm and $\beta_1 = 60^o$. [15]

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