Code No: R1622032 **R16** SET - 1

II B. Tech II Semester Supplementary Examinations, April - 2021
THERMAL ENGINEERING-I
(Com to ME, AME)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **FOUR** Questions from **Part-B**

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PART –A

1. a) Define time and heat loss factors. (2M)
   b) State the purpose of thermostat in an engine cooling system. (3M)
   c) List the four stages of combustion in CI engine. (2M)
   d) Define the brake power. (2M)
   e) Give the expression for work done for a two-stage compression with prefect intercooling. (3M)
   f) List various advantages of centrifugal compressors over axial flow compressors. (2M)

PART -B

2. a) Write short note on Actual and Fuel-Air Cycles of CI Engines. (7M)
   b) Discuss the various factors affecting the volumetric efficiency. (7M)

3. a) Draw the sketch of a four stroke SI engine valve timing diagram and explain. (7M)
   b) Explain the splash lubrication system with the help of a neat sketch. (7M)

4. a) What are different methods to control the knocking in S.I. Engine? Explain. (7M)
   b) What is the difference between physical delay and chemical delay? Explain its importance. (7M)

5. a) In a test of a four-cylinder, four – stroke engine 75 mm bore and 100 mm stroke, the following results were obtained at full throttle at a particular constant speed and with fixed setting of fuel supply of 6.0 kg/h. (7M)
   B.P. with all cylinder working = 15.6 kW;
   B.P. with cylinder no 1 cut –out = 11.1 kW;
   B.P. with cylinder no 2 cut –out = 11.03 kW;
   B.P. with cylinder no 3 cut –out = 10.88 kW;
   B.P. with cylinder no 4 cut –out = 10.66 kW;
   If the calorific value of the fuel is 83600 kJ/kg and clearance volume is 0.0001 m^3. Calculate: (i) Mechanical efficiency. (ii) Indicated thermal efficiency. (iii) Air standard efficiency.
   b) Following observations were recorded during a single cylinder oil engine bore 300 mm, stroke 450 mm, speed 300 rpm, IMPE 6 bar, net brake load 1.5 kN, brake drum diameter 1.8 meters, brake rope diameter 2 cm. Calculate the (i) Indicated power. (ii) Brake power. (iii) Mechanical efficiency. (7M)

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6. a) Derive the expression for work done per kg of air delivered for a single acting single cylinder reciprocating compressor considering clearance. (7M)
   b) A single acting reciprocating compressor having L/D ratio = 1.5 has the cylinder diameter of 200 mm runs at 100 rpm. The compressor compresses air at 1 bar, 300 K to a pressure of 8 bar according to the law $pv^{1.25}$ = constant. Find the indicated power of the compressor, mass of air delivered, temperature of air delivered. Also calculate power required to drive the compressor if mechanical efficiency is 80%. (7M)

7. a) Explain the terms slip factor and power input factor in centrifugal compressors? (7M)
   b) An axial flow compressor having eight stages and with 50% reaction compresses air in the pressure ratio of 4:1. The air enters the compressor at 20^0C and flows through it with a constant speed of 90m/s. The rotating blades of compressor rotate with a mean speed of 180m/s. Isentropic efficiency of the compressor may be taken as 82%. Calculate: i) Work done by the machine, ii) Blades angles. (7M)

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II B. Tech II Semester Regular/Supplementary Examinations, November - 2020
THERMAL ENGINEERING-I
(Com to ME, AME)

Time: 3 hours Max. Marks: 70

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PART –A

1. a) What are assumptions made in air standard cycles? (2M)
   b) List the main parts of a lubrication system. (3M)
   c) Define the phenomenon Knocking in spark ignited engines. (2M)
   d) How can you improve the performance of IC engine. (2M)
   e) Evaluate the necessity of clearance in reciprocating compressors. (3M)
   f) Give two examples of positive displacement and rotary compressors. (2M)

PART -B

2. a) Why the actual cycle efficiency is much lower than the air standard cycle efficiency? List the major losses in the actual engine. (7M)
   b) Write a note in Exhaust blow-down losses. (7M)

3. a) Discuss the difference between theoretical and actual valve timing diagram of a diesel engine. (7M)
   b) With the help of a neat sketch explain the working of fuel supply system of an IC engine. (7M)

4. a) Explain normal and abnormal combustions in SI engine. (7M)
   b) What are the types of combustion chambers used in C.I. engines and explain their role in generating turbulence. (7M)

5. a) List the different methods used for finding friction power and indicated power of an engine Explain in detail. (7M)
   b) A test on a single-cylinder, four-stroke oil engine having a bore of 15 cm and stroke 30 cm gave the following results; speed 300 rpm; brake torque 200 Nm; indicated mean effective pressure 7 bar; fuel consumption 2.4 kg/h; cooling water flow 5 kg/min; cooling water temperature rise 35^0C; air-fuel ratio 22; exhaust gas temperature 410^0C; barometer pressure 1 bar; room temperature 20^0C. The fuel has a calorific value of 42 MJ/kg and contains 15% by weight of hydrogen. Take latent heat of vaporization as 2250 kJ/kg. Determine: (i) The indicated thermal efficiency. (ii) The volumetric efficiency based on atmospheric conditions. Draw up a heat balance in terms of kJ/min. Take $C_p$for dry exhaust gas = 1 kJ/kgK and super-heated steam C_p = 2.1 kJ/kgK; R = 0.287 kJ/kgK. (7M)
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6. a) Derive the work done for a single stage air compressor with and without clearance volume. (7M)
   b) A single stage single acting reciprocating air compressor takes in 17 m^3/min at suction conditions of 100 KPa and 25^0C. The delivery pressure is 700 KPa. The clearance volume is 6% of swept volume. The compression and expansion follows the law $PV^{1.3} = C$. The speed of the compressor is 600 rpm. Stroke to bore ratio is 1. Find the power required to drive the compressor and cylinder dimensions. (7M)

7. a) With help of a neat sketch explain the construction and working of an axial flow compressor. (7M)
   b) Draw the velocity triangles for the centrifugal compressor and derive the equation for the estimation of power required to compress the air. (7M)

II B. Tech II Semester Supplementary Examinations, November - 2019
THERMAL ENGINEERING-I
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PART –A

1. a) Draw the P-v plot of actual cycle and Fuel-air cycle for the optimum spark advance. (3M)
   b) What is the need of providing lubrication to the IC engine? (2M)
   c) What is meant by delay period? (2M)
   d) Define Volumetric efficiency? Explain its importance for calculation of volumetric efficiency in the performance test? (3M)
   e) Define the volumetric efficiency of the reciprocating compressor. (2M)
   f) Define degree of reaction for the axial flow compressor? (2M)

PART –B

2. a) Briefly discuss pumping, rubbing friction losses and gas exchange process. (7M)
   b) Define volumetric efficiency and discuss the effect of various factors affecting the volumetric efficiency. (7M)
3. a) Explain the wet sump lubrication system with neat sketch. (7M)
   b) Explain about the Forced circulation cooling system with neat sketch. (7M)
4. a) Explain the phenomenon of knock in SI engines. (7M)
   b) Explain with figures the various types of combustion chambers used in SI engines. (7M)
5. a) Why morse test is not used for single cylinder engine? Describe the method of finding friction power using Morse test. (7M)
   b) A four cylinder engine running at 1200 rpm delivers 20kW.The average torque when one cylinder was cut is 110 Nm. Find the indicated thermal efficiency if the calorific value of the fuel is 43 MJ/kg and the engine uses 360 grams of gasoline per kW h. (7M)
6. A single-acting two stage air compressor delivers air at 18 bar. The temperature and pressure of the air before the compression in LP cylinder are 25^0C and 1 bar. The discharge pressure of LP cylinder is 4.2 bar. The pressure of air leaving the intercooler is 4 bar and the air is cooled to 25^0C.The diameter and stroke of LP cylinder are 40 cm and 50 cm respectively. The clearance volume is 5% stroke in both cylinders. The speed of the compressor is 200 rpm. Assuming the index of compression and re-expansion in both the cylinders as 1.25 , C_p for air = 1.004 kJ/kgK, find (14M)
   (i) Power required to run the compressor and
   (ii) Heat rejected in intercooler/min
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7. Air at a temperature of 290 K flows in a centrifugal compressor running at 20000 rpm. The other data is as follows: (14M)
Slip factor= 0.80 ; Isentropic total head efficiency =0.75 ; Outer diameter of blade tip = 500 mm
Determine :
   (i) The temperature rise of air passing through the compressor
   (ii) The static pressure ratio.
   (iii) Assume that the velocities of air at inlet and exit of the compressor are same