Code No: RT22032 **R13** SET - 1

II B. Tech II Semester Regular/Supplementary Examinations, April/May-2017
THERMAL ENGINEERING-I
(Mechanical Engineering)

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 **THREE** Questions from **Part-B**

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PART –A

1. a) What is heat loss factor? (3M)

   b) What do you understand by supercharging? (4M)

   c) What are the different types of combustion chambers used in SI engine? (4M)

   d) Define specific fuel consumption. (3M)

   e) Draw the p-v and T-s diagram for a single acting reciprocating air compressor. (4M)

   f) What is the difference between rotary and reciprocating compressor? (4M)

PART -B

2. a) Explain why actual cycle efficiency is much lower than the air standard cycle efficiency. (8M)
   b) Discuss the various factors affecting the volumetric efficiency. (8M)

3. a) With a neat sketch explain the working principle of a simple carburetor. (8M)

   b) Discuss the various characteristics of an efficient cooling system. (8M)

4. a) Explain briefly the effect of different factors on knock in SI engines? (8M)

   b) Explain the term delay period as referred to CI engines. Explain the effect of speed and fuel-air ratios on delay period of CI engines. (8M)
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5. a) What is the use of heat balance sheet of an engine? Discuss the various items to be determined to complete the heat balance sheet. (6M)

   b) A trial was conducted on a single-cylinder oil engine having a cylinder diameter of 30 cm and stroke 45 cm. The engine is working on the four-stroke cycle and the following observations were made: (10M)

Duration of trial	=	54 minutes
Total fuel used	=	7 liters
Calorific value	=	42 MJ/kg
Total number of revolution	=	12624
Gross imep	=	7.25 bar
Pumping imep	=	0.35 bar
Net load on the brake	=	150 kg
Diameter of the brake wheel drum	=	1.78 m
Diameter of the rope	=	4 cm
Cooling water circulated	=	550 liters
Cooling water temperature rise	=	48^0C
Specific heat of water	=	4.18 kJ/kg K
Specific gravity of oil	=	0.8

   Calculate the mechanical efficiency and also the unaccounted losses

6. a) Derive the expression for work done when compression is isothermal for a single stage reciprocating air compressor. (8M)

   b) An air compressor takes in air at 1 bar and 20^0C and compresses it according to law $pv^{1.2}$=constant. It is then delivered to a receiver at a constant pressure of 10 bar. R= 0.287 kJ/kg K. Determine: (8M)
   (i) Temperature at the end of compression;
   (ii) Work done and heat transferred during compression per kg of air.

7. a) Explain, with a neat sketch, the working of a centrifugal compressor and obtain an expression for the work done. (8M)

   b) A rotary air compressor working between 1 bar and 2.5 bar has internal and external diameters of impeller as 300 mm and 600 mm respectively. The vane angle at inlet and outlet are 30^0 and 45^0 respectively. If the air enters the impeller at 15 m/s, find: i) speed of the impeller in rpm and ii) work done by the compressor per kg of air. (8M)

Code No: RT22032 **R13** SET - 2

II B. Tech II Semester Regular/Supplementary Examinations, April/May-2017
THERMAL ENGINEERING-I
(Mechanical Engineering)

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 **THREE** Questions from **Part-B**

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PART –A

1. a) What is time loss factor? (3M)
   b) What do you understand by turbo charging? (4M)
   c) Explain how are SI engine fuels are rated? (4M)
   d) Define mean effective pressure. (3M)
   e) State the conditions which lower the volumetric efficiency of a single acting reciprocating air compressor. (4M)
   f) Differentiate between centrifugal compressor and axial flow compressor. (4M)

PART -B

2. a) Explain the differences between actual and ideal fuel air cycles of C.I. engines. (8M)
   b) Discuss the optimum opening position of exhaust valve to reduce the exhaust blow-down loss. (8M)

3. a) Discuss the various important qualities of a good ignition system? (8M)
   b) Explain (i) Thermo-syphon cooling system (8M)
   (ii) Pressure cooling system

4. a) Discuss the desirable characteristics of a good combustion chamber for an SI engine. (8M)
   b) Classify and explain the CI engine combustion chambers. (8M)

5. a) Enumerate the various engine efficiencies. Explain? (6M)
   b) A gasoline engine working on four stroke develops a brake power of 20.9 kW. A Morse test was conducted on this engine and the brake power (kW) obtained when each cylinder was made inoperative by short circulating the spark plug are 14.9, 14.3, 14.8 and 14.5 respectively. The test was conducted at constant speed. Find the indicator power, mechanical efficiency and bmep when all the cylinders are firing. The bore of the engine is 75 mm and the stroke is 90 mm. The engine is running at 3000 rpm. (10M)
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Code No: RT22032 **R13** SET - 2

6. a) Explain the effect of intercooling in multi-stage reciprocating compressor. (6M)

   b) A single-stage double-acting air compressor is required to 14 m^3 of air per minute measured at 1.013 bars and 15^0C. The delivery pressure is 7 bar and the speed 300 rpm. Take the clearance volume as 5% of the swept volume with the compression and expansion index of n=1.3. Calculate: (10M)
   (i) Swept volume of the cylinder
   (ii) The delivery temperature
   (iii) Indicated power

7. a) Explain in detail the construction and working of Lysholm compressor. (8M)

   b) A centrifugal air compressor having a pressure compression ratio of 5 compresses air at the rate of 10 kg/s. If the initial pressure and temperature of the air is 1 bar and 20^0C, find (i) the final temperature of the gas and (ii) power required to drive the compressor. Take γ=1.4 and C_p=1 kJ/kg K. (8M)

Code No: RT22032 **R13** SET - 3

II B. Tech II Semester Regular/Supplementary Examinations, April/May-2017
THERMAL ENGINEERING-I
(Mechanical Engineering)

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 **THREE** Questions from **Part-B**

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PART –A

1.	a)	What is rubbing friction loss?	(3M)
	b)	Discuss the need and importance of cooling an IC engine.	(4M)
	c)	Explain how CI engine fuels are rated?	(4M)
	d)	What do you understand by calorific value of the fuel?	(3M)
	e)	What do you mean by multi-stage compression? State its advantages.	(4M)
	f)	Define isothermal efficiency of air compressor.	(4M)

PART -B

2.	a)	Explain in detail about exhaust blow-down and loss due to gas exchange process.	(8M)
	b)	How does the composition of exhaust gases vary for various fuel air ratios in a gasoline engine?	(8M)
3.	a)	Derive an expression for air fuel ratio of a simple carburetor?	(8M)
	b)	With a neat sketch, explain the battery ignition system?	(8M)
4.	a)	Discuss the various methods for improving the anti-knock quality of an SI engine.	(8M)
	b)	Explain and discuss the phenomenon of diesel knock in CI engines and compare the same with detonation in SI engines.	(8M)
5.	a)	Explain Rope brake dynamometer to determine the brake power of an engine?	(6M)
	b)	A six cylinder, four-stroke gasoline engine having a bore of 90 mm and stroke of 100 mm has a compression ratio 7. The relative efficiency is 55% when the indicated specific fuel consumption is 300 gm/kW h. Estimate (i) the calorific value of the fuel and (ii) corresponding fuel consumption, given that imep is 8.5 bar and speed is 2500 rpm.	(10M)
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Code No: RT22032 **R13** SET - 3

6. a) Derive the expression for work done when compression is isentropic for a single stage reciprocating air compressor. (6M)
   b) A single-stage single-acting air compressor delivers 0.6 kg of air per minute at 6 bar. The temperature and pressure at the end of suction stroke are 30^0C and 1 bar. The bore and stroke of the compressor are 100 mm and 150 mm respectively. The clearance is 3% of the swept volume. Assuming the index of compression and expansion to be 1.3, find: (10M)
   (i) Volumetric efficiency of the compressor
   (ii) Power required if the mechanical efficiency is 85%, and
   (iii) Speed of the compressor (rpm).

7. a) Derive an expression for efficiency of a Roots blower in terms of pressure ratio and ratio of specific heats. (6M)
   b) A centrifugal air compressor having isentropic efficiency of 70% receives air at 17^0C. If the outer diameter of the blade tip is 1 m and the compressor runs at 5000 rpm find: (10M)
   (i) The temperature rise of the air and (ii) the static pressure ratio.

Code No: RT22032 **R13** SET - 4

II B. Tech II Semester Regular/Supplementary Examinations, April/May-2017
THERMAL ENGINEERING-I
(Mechanical Engineering)

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 **THREE** Questions from **Part-B**

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PART –A

1. a) What do you understand by volumetric efficiency of an IC engine? (3M)
   b) Discuss the need for lubricating an IC engine. (4M)
   c) How does the injection timing and fuel quality affect the engine knock? (4M)
   d) Define mechanical efficiency of an IC engine. (3M)
   e) Discuss the classification of air compressors. (4M)
   f) Define isentropic efficiency of air compressor. (4M)

PART -B

2. a) Discuss the various assumptions used in fuel-air cycle analysis? (8M)
   b) From the point of view of fuel-air analysis how does fuel-air ratio affect efficiency, maximum power, temperature and pressure in a cycle. (8M)

3. a) How are injection systems classified? Describe them briefly. (8M)
   b) Explain the principle of Wankle engine? (8M)

4. a) What are the basic parameters that influence the flame speed? Discuss the influence of engine variables on the flame speed? (8M)
   b) What is diesel knock? How to minimize knocking in CI engine? (8M)

5. a) With the help of a neat sketch, the working of a mechanical indicator to determine the indicated power of an engine? (6M)
   b) A four-stroke, four-cylinder gasoline engine has a bore of 60 mm and a stroke of 100 mm. on test it develops a torque of 66.5 Nm when running at 3000 rpm. If the clearance volume in each cylinder is 60 cc the relative efficiency with respect to brake thermal efficiency is 0.5 and the calorific value of the fuel is 42 MJ/kg, determine the fuel consumption in kg/h and the brake mean effective pressure. (10M)
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Code No: RT22032 **R13** SET - 4

6. a) Discuss briefly a two stage air compressor with inter cooler. (6M)
   b) A two-cylinder single-acting air compressor is to deliver 16 kg of air per minute at 7 bars from suction conditions 1 bar and 15^0C. Clearance may be taken as 4% of stroke volume and the index for both compression and re-expansion as 1.3. Compressor is directly coupled to a four-cylinder four-stroke petrol engine which runs at 2000 rpm with a brake mean effective pressure of 5.5 bar. Assuming a stroke-bore ratio of 1.2 for both engine and compressor and a mechanical efficiency of 82% for compressor, calculate the required cylinder dimensions (10M)

7. a) Describe with a neat sketch, the working of a vane blower compressor and show its p-v diagram. For what applications, it is used? (8M)
   b) A centrifugal compressor with 70% isentropic efficiency delivers 20 kg of air per minute at a pressure of 3 bar. If the compressor receives air at 20^0C and at a pressure of 1 bar, find the actual temperature of the air at exit. Also find the power required to run the compressor, if its mechanical efficiency is 95%. Take ɣ and C_p for air as 1.4 and 1 kJ/kg K respectively. (8M)