Code No: A109211401 **R09** **Set No. 2**

II B.Tech I Semester Examinations,November 2010
THERMAL SCIENCE
Common to Mechatronics, Production Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What is the qualitative difference between heat and work? Why are heat and work are not completely interchangeable forms of energy?
   (b) What is a cyclic heat engine? [8+7]
2. (a) Explain the important components of a simple vapour compression refrigeration system. Also discuss the functions of each component.
   (b) Discuss the effect of sub cooling on C.O.P. of the vapour compression refrigeration cycle. Would you derive large sub cooling and why? [8+7]
3. (a) Explain the phenomena of detonation in S.I. Engine? How it is different from C.I. Engine
   (b) What are different uses of cooling in I. C. Engines? [8+7]
4. (a) What are different modes of fuel admission to engine cylinder?
   (b) Sketch a typical induction system of a petrol engine? [8+7]
5. (a) Explain the similarities and differences between heat and work.
   (b) Under what condition is the work done equal to $\int_1^2 p\,dv$. [8+7]
6. (a) In an engine working on the otto cycle the measured suction temperature was 100 ^{0}C and the temperature at the end of compression was 300 ^{0}C. Taking γ for compression as 1.41, find the ideal efficiency and the compression ratio.
   (b) Derive an expression for the mean effective pressure of Diesel cycle. [8+7]
7. (a) Draw the schematic layout of gas turbine cycle with regenerator, intercooler and reheating. Explain salient features.
   (b) Derive the thermal efficiency of gas turbine unit with multi stage compression with intercooling. [8+7]
8. (a) What do you understand by the ideal gas temperature scale?
   (b) What will be the velocity of a fluid leaving a nozzle, if the velocity of approach is very small? [10+5]

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Code No: A109211401 **R09** **Set No. 4**

II B.Tech I Semester Examinations,November 2010
THERMAL SCIENCE
Common to Mechatronics, Production Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) What are the major applications of gas turbine cycle? Explain
   (b) What are the advantages and limitations of reheating gas turbine cycle with multi-stage expansion. [8+7]
2. (a) What do you understand by a thermodynamic process? Distinguish between reversible and irreversible process.
   (b) What do you understand by property of a system? Distinguish between extensive and intensive properties of a system. [8+7]
3. (a) Draw the schematic diagram of a Simple carburetor and explain its functionality with different conditions.
   (b) What are different types of nozzles used in C.I. Engine fuel injector and explain its working. [8+7]
4. (a) State the principle of conservation of energy.
   (b) What is perpetual motion machine of first kind (PMM1).Is it possible to devise a PMM-1 kind? If not explain why.
   (c) Which principle is made use of in devising the ideal gas temperature scale? [4+7+4]
5. (a) A Diesel engine works on Diesel cycle with a compression ratio of 15 and cut-off ratio of 1.75. Calculate the air-standard efficiency assuming $\gamma = 1.4$.
   (b) What do you mean by the term air standard efficiency? State the assumptions made to derive the equation of air standard efficiency of an engine. [8+7]
6. (a) What is the function of a fan in cooling system? Is it always required?
   (b) Discuss the merits and the demerits of air and water cooling systems. [5+10]
7. (a) Prove that violation of the clausius statement leads to violation of the Kelvin-Planck of the second law of thermodynamics.
   (b) The efficiency of a reversible heat engine which rejects energy at a rate of a 500 KW to a reservoir at 20 ^{0}C is 0.6. Calculate the power output of the engine and the temperature of the source which supplies energy as heat to the engine. [8+7]
8. In an open cycle air refrigeration machine, air is drawn from a cold chamber at-2^o C and 1 bar and compressed to 11 bar. It is then cooled at this pressure, to the cooler

temperature of 20^0 C and then expanded in expansion cylinder and returned to the cold room. The compression and expansion are isentropic, and follow the low $pv^{1.3}$ =constant. Sketch the p-v and T-s diagrams of the cycle and the for a refrigeration of 15 tonnes, find: 1. theoretical C.O.P; 2. rate of the air in kg/min ; 3. piston displacement per minute in the compressor and expander ; and 4. theoretical power per tonne of refrigeration. [15]

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Code No: A109211401 **R09** **Set No. 1**

II B.Tech I Semester Examinations,November 2010
THERMAL SCIENCE
Common to Mechatronics, Production Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) How many fixed points were used prior to 1954, what are those?
   (b) Show that the internal energy is a property of the system? [8+7]
2. (a) Explain perpetual motion machine of first and second kind.
   (b) Explain carnot Engine and carnot cycle. Prove that $\eta_{carnot} = \frac{T_1 - T_2}{T_1}$. [8+7]
3. (a) Why lubrication system is required in I. C. Engines? Explain one of the lubrication system.
   (b) What are the limitations of simple carburetor? How to avoid those limitations. [8+7]
4. (a) Differentiate between the gas turbine units and I.C. Engines.
   (b) Draw the schematic layout of gas turbine cycle with intercooling, reheating and regeneration. Explain the working along with T-s and p-V diagrams. [8+7]
5. (a) What are the different forms of energy? Define potential energy and kinetic energy?
   (b) A gas undergoes a reversible non flow process according to the relation p=(-2v+14) where v is the volume in m^3 and p is the pressure in bar. Determine the work done when the volume changes from 3 to 6 m^3. [5+10]
6. (a) Why the ignition system is necessary for S.I.engine? Explain.
   (b) What are the types of ignition system and describe the working of Battery ignition system. [5+10]
7. In an ammonia vapour compression system, the pressure in the evaporator is 2 bar. Ammonia at exit is 0.85 dry and at entry its dryness fraction is 0.19. During compression, the work done per kg of ammonia is 150 kJ. Calculate the C.O.P. and volume of vapour entering the compressor per minute, if the rate of ammonia circulation is 4,5 kg / min. the latent heat and specific volume at 2 bar are 1325 kJ / kg and 0.58 m^3 / kg respectively. [15]
8. In an air standard Diesel cycle, the compression ratio is 16, and at the beginning of isentropic compression, the temperature is 15 ^{0}C and the pressure is 0.1 MPa. Heat is added until the temperature at the end of the constant pressure process is 1480 ^{0}C. Calculate:

(a) The cut-off ratio
(b) The heat supplied per kg of air
(c) The cycle efficiency and
(d) The m.e.p. [15]

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Code No: A109211401 **R09** **Set No. 3**

II B.Tech I Semester Examinations,November 2010
THERMAL SCIENCE
Common to Mechatronics, Production Engineering

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) State with reasoning whether the following systems are closed, open or isolated:
   i. IC engine
   ii. Refrigerator
   iii. Pressure cooker.
   (b) Explain thermodynamic properties, processes and cycle. [10+5]
2. (a) State the clausius form of the second law of thermodynamics.
   (b) Develop the thermodynamics (Kelvin) scale of temperature.
   (c) How are the performance parameters of a heat pump and a refrigerator defined? [6+5+4]
3. (a) State and explain the four processes of the diesel cycle.
   (b) A diesel engine has compression ratio of 14 and cut-off takes place at 6% of the stroke. Find the air standard efficiency. [8+7]
4. (a) What is a constant volume gas thermometer? Why is it preferred to a constant pressure gas thermometer?
   (b) What is the difference heat and internal energy? [10+5]
5. (a) What are different methods to control the knocking in S.I. Engine? Explain.
   (b) What is the generally used governing mechanism in controlling the speed of C.I. Engine. Explain with a suitable diagram [8+7]
6. (a) Derive the expression for COP of vapour compression refrigeration system in terms of enthalpies.
   (b) Explain effects of under cooling and super heating on COP of vapour compression refrigerator system with the help of P-V & T-S diagrams. [8+7]
7. (a) For a diesel engine, give the lay-out of the fuel system naming the essential components and explain their roles.
   (b) Why do designers go for multicylinder engines for heavy loads and name some multicylinder engine types. [10+5]
8. (a) What are different parameters influence the performance of gas turbine cycle. Explain.

(b) In a gas turbine power cycle, the pressure ratio is 6 and the maximum cycle temperature is 650^0C. The air enters to the cylinder at 15^0C and the flow rate of air is 12 kg/s. Determine the power developed and thermal efficiency of cycle. [8+7]

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