Code No: NR/RR221403 | NR/RR | Set No. 2

II B.Tech II Semester Examinations,December 2010
THERMAL ENGINEERING AND HEAT TRANSFER
Common to Mechatronics, Production Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Explain the principle of carburetion.
   (b) With a neat sketch explain the working of principle of a simple carburettor. [6+10]

2. Briefly discuss the air-fuel ratio requirements of a petrol engine from no load to full load. [16]

3. (a) Derive the general conduction equation in rectangular coordinates
   (b) A wall is made up of two layers of bricks each 15 cm thick with a 5 cm air space between them. The coefficients of thermal conductivities are: inside brick = 0.7 W/mK, Air = 0.061 W/mK outside brick = 1.04 W/mK. The wall is 6 m long and 5 m high. Determine the heat loss per hour through the wall if the inside face temperature is 24^0C and outside face temperatures is 7^0C. [8+8]

4. (a) Sketch a line diagram of a semi-closed gas turbine cycle. Indicate its place of operation.
   (b) Discuss the relative advantages and disadvantages of reciprocating I.C.engines and gas turbines. [8+8]

5. (a) State and explain Kirchoff's Law of radiation.
   (b) Derive an expression for the rate of heat transfer by radiation between two parallel surfaces of equal area A separated by a small distance. The respective temperatures of the two surfaces are T_1 and T_2 while the emissivities are E_1 and E_2. The Stefan-Boltzmann constant is σ. [4+12]

6. The parallel outer and inner walls of a building are 4m high and 5m long. The walls are 10 cm apart. The inner surface of the inner wall is at 25^0C and the inner surface of the outer wall is at 5^0C.
   (a) Calculate the total heat loss per hour.
   (b) If the air space is divided in half by a sheet of aluminium foil 0.025 mm thick parallel to the walls, what would be the heat loss per hour. [16]

7. When an Otto cycle works between T_1 and T_3 then prove that the compression ratio for the maximum output per kg of working fluid is given by
   $R_e = \sqrt{(T_3/T_1)^{1/\gamma-1}}$ and
   The intermediate temperature of the working fluid is given by $T_2 = T_4 = \sqrt{T_1 \bullet T_3}$ [16]

8. The following observations are made during a trial on an oil engine:

Motor Power to start the engine	=	10kW
R.P.M	=	1750
Brake Torque	=	327.5Nm
Fuel used	=	15kg/hr
Calorific value of fuel used	=	42MJ/kg
Air supplied	=	4.75kg/min
Quantity of cooling water	=	16kg/min
Outlet temperature of cooling water	=	65^0 C
Room temperature	=	20^0 C
Exhaust gas temperature	=	400^0 C

Take C_{pw} = 4.2 kJ/kg.k and C_{pg} = 1.25 kJ/kg k
Determine

(a) B.P.

(b) Mechanical efficiency

(c) BSFC

(d) Draw a heat balance sheet on kW basis and percentage basis. [16]

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Code No: NR/RR221403 | NR/RR | Set No. 4

II B.Tech II Semester Examinations,December 2010
THERMAL ENGINEERING AND HEAT TRANSFER
Common to Mechatronics, Production Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) State and explain Kirchoff's Law of radiation.
   (b) Derive an expression for the rate of heat transfer by radiation between two parallel surfaces of equal area A separated by a small distance. The respective temperatures of the two surfaces are T_1 and T_2 while the emissivities are E_1 and E_2. The Stefan-Boltzmann constant is σ. [4+12]

2. The following observations are made during a trial on an oil engine:

Motor Power to start the engine	=	10kW
R.P.M	=	1750
Brake Torque	=	327.5Nm
Fuel used	=	15kg/hr
Calorific value of fuel used	=	42MJ/kg
Air supplied	=	4.75kg/min
Quantity of cooling water	=	16kg/min
Outlet temperature of cooling water	=	65^0 C
Room temperature	=	20^0 C
Exhaust gas temperature	=	400^0 C

   Take C_{pw} = 4.2 kJ/kg.k and C_{pg} = 1.25 kJ/kg k
   Determine
   (a) B.P.
   (b) Mechanical efficiency
   (c) BSFC
   (d) Draw a heat balance sheet on kW basis and percentage basis. [16]

3. (a) Sketch a line diagram of a semi-closed gas turbine cycle. Indicate its place of operation.
   (b) Discuss the relative advantages and disadvantages of reciprocating I.C.engines and gas turbines. [8+8]

4. (a) Derive the general conduction equation in rectangular coordinates
   (b) A wall is made up of two layers of bricks each 15 cm thick with a 5 cm air space between them. The coefficients of thermal conductivities are: inside brick = 0.7 W/mK, Air = 0.061 W/mK outside brick = 1.04 W/mK. The wall is 6 m long and 5 m high. Determine the heat loss per hour through the wall if the inside face temperature is 24^0C and outside face temperatures is 7^0C. [8+8]

5. (a) Explain the principle of carburetion.

(b) With a neat sketch explain the working of principle of a simple carburettor. [6+10]

6. The parallel outer and inner walls of a building are 4m high and 5m long. The walls are 10 cm apart. The inner surface of the inner wall is at 25^0C and the inner surface of the outer wall is at 5^0C.

   (a) Calculate the total heat loss per hour.

   (b) If the air space is divided in half by a sheet of aluminium foil 0.025 mm thick parallel to the walls, what would be the heat loss per hour. [16]

7. When an Otto cycle works between T_1 and T_3 then prove that the compression ratio for the maximum output per kg of working fluid is given by $R_e = \sqrt{(T_3/T_1)^{1/\gamma-1}}$ and
   The intermediate temperature of the working fluid is given by $T_2 = T_4 = \sqrt{T_1 \bullet T_3}$ [16]

8. Briefly discuss the air-fuel ratio requirements of a petrol engine from no load to full load. [16]

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Code No: NR/RR221403 | NR/RR | Set No. 1

II B.Tech II Semester Examinations,December 2010
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Common to Mechatronics, Production Engineering

Time: 3 hours **Max Marks: 80**

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2. (a) Sketch a line diagram of a semi-closed gas turbine cycle. Indicate its place of operation.
   (b) Discuss the relative advantages and disadvantages of reciprocating I.C.engines and gas turbines. [8+8]

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Quantity of cooling water	=	16kg/min
Outlet temperature of cooling water	=	65^0 C
Room temperature	=	20^0 C
Exhaust gas temperature	=	400^0 C

   Take C_{pw} = 4.2 kJ/kg.k and C_{pg} = 1.25 kJ/kg k
   Determine
   (a) B.P.
   (b) Mechanical efficiency
   (c) BSFC
   (d) Draw a heat balance sheet on kW basis and percentage basis. [16]

5. (a) Derive the general conduction equation in rectangular coordinates
   (b) A wall is made up of two layers of bricks each 15 cm thick with a 5 cm air space between them. The coefficients of thermal conductivities are: inside brick = 0.7 W/mK, Air = 0.061 W/mK outside brick = 1.04 W/mK. The wall is 6 m long and 5 m high. Determine the heat loss per hour through the wall if the inside face temperature is 24^0C and outside face temperatures is 7^0C. [8+8]

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   (b) Derive an expression for the rate of heat transfer by radiation between two parallel surfaces of equal area A separated by a small distance. The respective temperatures of the two surfaces are T_1 and T_2 while the emissivities are E_1 and E_2. The Stefan-Boltzmann constant is σ. [4+12]

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8. The parallel outer and inner walls of a building are 4m high and 5m long. The walls are 10 cm apart. The inner surface of the inner wall is at 25^0C and the inner surface of the outer wall is at 5^0C.
   (a) Calculate the total heat loss per hour.
   (b) If the air space is divided in half by a sheet of aluminium foil 0.025 mm thick parallel to the walls, what would be the heat loss per hour. [16]

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Code No: NR/RR221403 | NR/RR | Set No. 3

II B.Tech II Semester Examinations,December 2010
THERMAL ENGINEERING AND HEAT TRANSFER
Common to Mechatronics, Production Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. The following observations are made during a trial on an oil engine:

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Brake Torque	=	327.5Nm
Fuel used	=	15kg/hr
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Outlet temperature of cooling water	=	65^0 C
Room temperature	=	20^0 C
Exhaust gas temperature	=	400^0 C

Take C_{pw} = 4.2 kJ/kg.k and C_{pg} = 1.25 kJ/kg k
Determine

   (a) B.P.
   (b) Mechanical efficiency
   (c) BSFC
   (d) Draw a heat balance sheet on kW basis and percentage basis. [16]

2. Briefly discuss the air-fuel ratio requirements of a petrol engine from no load to full load. [16]

3. (a) Derive the general conduction equation in rectangular coordinates
   (b) A wall is made up of two layers of bricks each 15 cm thick with a 5 cm air space between them. The coefficients of thermal conductivities are: inside brick = 0.7 W/mK, Air = 0.061 W/mK outside brick = 1.04 W/mK. The wall is 6 m long and 5 m high. Determine the heat loss per hour through the wall if the inside face temperature is 24^0C and outside face temperatures is 7^0C. [8+8]

4. (a) State and explain Kirchoff's Law of radiation.
   (b) Derive an expression for the rate of heat transfer by radiation between two parallel surfaces of equal area A separated by a small distance. The respective temperatures of the two surfaces are T_1 and T_2 while the emissivities are E_1 and E_2. The Stefan-Boltzmann constant is σ. [4+12]

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