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SF-6507

B. E. - II (Sem - IV) (Electrical) Examination

May / June – 2011

Applied Thermodynamics & Thermal Engineering

Time : **3** Hours] [Total Marks : **100**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **B. E. - 2 (Sem - 4) (Electrical)**

Name of the Subject :

☛ **Applied Thermodynamics & Thermal Engineering**

☛ Subject Code No. : **6 5 0 7** ☛ Section No. (1, 2,.....) : **Nil**

Seat No. :

Student's Signature

(2) Attempt all questions.

(3) Figures to the right inidcate full marks.

1 (A) Attempt all questions. **10**

(1) An extensive property is _____ .
(Pressure, temperature, density, enthalpy)

(2) When neither mass nor energy is allowed to cross the boundary of a system it is then called _____.
(closed system, open system, isolated system)

(3) Atmospheric pressure is equal to _____ .
(1.013 bar, 1.2 bar, 1.5 bar, 2 bar)

(4) _____ boiler has a drum.
(La.mont, Bension, Velox)

(5) The function of superheater is used to _____.
(a) Convert steam into water
(b) Convert atms. air into hot air
(c) Convert cold water into hot water
(d) Convert steam into superheated steam

(6) The isentropic expansion of steam through nozzle for the steam initially superheated at inlet is approximated by equation

(a) $PV^{1.3} = c$

(b) $PV^{1.2} = c$

(c) $PV^{1.4} = c$

(d) $PV = c$

(7) _____ is the working pressure range of high pressure boiler.

(a) less then 3.5 bar

(b) between 3.5 to 10 bar

(c) between 10 to 25 bar

(d) more then 25 bar

(8) Basic closed cycle for gas turbine is

(a) Carnot cycle

(b) Rankine cycle

(c) Brayton cycle

(d) Stirling cycle

(9) Thermal efficiency of a gas turbine plant as compared to diesel engine plant is

(a) lower

(b) higher

(c) same

(d) unpredictable

(10) Pressure ratio for a gas turbine may be in the range of

(a) 2 to 3

(b) 3 to 5

(c) 16 to 18

(d) 18 to 22

(b) (i) Explain with neat sketch of working of La-mont boiler. **8**

(ii) Write advantages of high pressure boilers. **2**

2 (a) State the Kelvin-Planck and clausius statements of of second law of thermodynamics and establish the equivalence between them. **6**

(b) State the limitation of first law of thermodynamics. **3**

(c) A carnot heat engine absorbs 15 kg of heat per second from a high temperature reservoir and it rejects certain amount of heat to a low temp. reservoir and in doing so, it produces 4 kW of power. If the temp. of high reservoir is 100^0c. Calculate the temperature of law temperature reservoirs ? **6**

3 (a) Explain various types of nozzles and their distinguishing features. **5**

(b) Derive an expression to obtain mass of steam discharge through a nozzle. **8**

(c) Define sonic velocity and Mach no. **2**

OR

(a) Explain the working of a simple open cycle gas turbine with a sketch. **7**

(b) Air at temperature of 15^0c enters a gas turbine plant working at pressure ration of 5. Trubine inlet temperature is 800^0c. Polytropic efficiency of compressor and turbine is 0.87. Assume C_p=1.005 kj/kgK for air ang gases and calorific value of fuel used = 42000 kj/kg of fuel. Calculate : (a) overall efficiency (b) specific output. **8**

4 (a) Attempt all questions. **10**

(i) State the methods of governing of steam turbine.

(ii) Define degree of reaction. State its value for parson turbine.

(iii) Differentiate between free and forced convertion.

(iv) Explain the concept of black body.

(v) State the difference between two and four stroke IC engine.

(b) With a neat sketch explain the valve timing diagram of 4 stroke petrol engine. **8**

5 (a) Explain how reheating improves the efficiency of steam turbine. **16**

(b) In a De Laval turbine steam issues from the nozzle with a velocity of 1200 m/s. The nozzle angle is 20^0, the mean blade velocity is 400 m/s. and the inlet and outlet angles of blades are equal. The mass of steam flowing through the turbine per hour is 1000 kg. Calculate :

(i) blade angles

(ii) power developed

(iii) blade efficiency

Take blade velocity coefficient as 0.8.

OR

5 (a) Explain the reasons for compounding of steam turbine. Explain velocity compounding. **16**

(b) The following data relate to a single stage impulse turbie :
steam velocity = 600 m/s, blade speed = 250 m/s, Nozzle angle = 20^0, blade outlet angle = 25^0.

Neglecting the effect of friction, calculate the work developed by the turbine for the steam flow rate of 20 kg/s. Also calculate the axial thrust on the tearings.

6 (a) Derive the relation for critical thichness of insulation for cylinder. **16**

(b) Explain the physical significance of following non-dimensional numbers :
(i) Nusset number
(ii) Prandtl number
(iii) Greshoff number

OR

(a) Derive the relation for critical thickness of insulation for sphere. **16**

(b) Explain the following terms :
(i) Absortivity
(ii) Diffuse rediation
(iii) Gray body
(iv) Kirchoff's law.