IX. (a) Explain the working of dust and ash handling system for a thermal power plant with a neat sketch. (8)

(b) What is draught? What are the functions of the draught system? (4)

(c) What are the functions of a condenser in a power plant? Explain the importance of tube arrangement in the condenser shell. (8)

OR

X. (a) Explain the working of a PWR with the help of a line diagram. (12)

(b) Explain the following terms:

(i) Breeding ratio
(ii) Burner
(iii) Breeder
(iv) Doubling (8)

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B.Tech. Degree IV Semester Examination November 2002

ME 403 THERMAL ENGINEERING II

(1998 Admissions)

Time: 3 Hours Maximum marks: 100

I. (a) Derive an expression giving relationship between change of cross section area of flow with pressure and velocity for a convergent-divergent nozzle. (8)

(b) Air at 15 atm pressure and 15°C enters a nozzle at a rate of 2.3 Kg/s and with a velocity of 50 m/s. It expands in the nozzle to a pressure of 1 atm. Determine the final velocity, specific volume and area at the exit when the (i) expansion is isentropic and (ii) efficiency of the nozzle is 90%. (12)

OR

II. (a) Derive the expression for maximum blade efficiency in a single stage impulse turbine. (7)

(b) Discuss the term 'reheat-factor'. Why its magnitude is always greater than unity. (6)

(c) Explain various methods of governing of steam turbines, giving merits and demerits of each. (7)

III. (a) Derive the equation for shaft work for a single stage air-compressor without clearance, considering isothermal compression. (8)

(b) A small single-acting compressor has a bore and stroke both of 10cm and is driven at 350 rpm. The clearance volume is 75cm^2 and the index of compression and expansion is 1.23. The suction pressure is 0.95 bar and the delivery is 7 bar. Calculate (i) the volume of free air at 1 bar and 20°C dealt with per minute, if the temperature at the start of compression is 30°C, and (ii) the mean effective pressure of the indicator diagram, assuming constant suction and delivery pressure. (12)

OR

(Turn over)

IV. (a) Compare rotary and reciprocating compressor and discuss the function of the impeller and the diffuser in a centrifugal compressor. (10)

(b) The free air delivered by a centrifugal compressor is 20kg/min. The suction condition is 1 bar and 20°C. The velocity of air at the inlet is 60m/s. The isentropic efficiency of the compressor is 70%. If the total head pressure ratio of the compressor is 3, find (i) the total head temperature of air at the exit of the compressor, and (ii) B.P. required to run the compressor assuming mechanical efficiency of 95%.
Pressure and temperature of air at inlet are static. Take $r = 1.4$, $R = 287$ Nm/Kg-K. (10)

V. (a) Derive the expression for the COP of a Bell-Coleman cycle in terms of compression ratio. (6)

(b) Discuss the suitability of air as a refrigerant for air craft. (4)

(c) In a Bell-Coleman refrigeration plant, the air is drawn from cold chamber at 1 bar and 10°C, and compressed to 5 bar the same is cooled to 25°C in the cooler before expanding in the expansion cylinder to cold chamber pressure of 1 bar. Determine the theoretical COP of the plant and the theoretical net refrigeration effect/Kg of air. The compression and expansion be assumed isentropic.
Assume $r = 1.41$, $C_p = 1.009$ KJ/Kg K. (10)

OR

VI. (a) Discuss the desirable characteristics of a fluid to be used as refrigerant. (8)

(b) A refrigerant plant of 28kW capacity has its evaporation temperature -8°C and condenser temperature of 30°C. The refrigerant R - 12 is sub-cooled 5°C before entering the expansion valve and vapour is superheated 6°C before leaving the evaporator coil. The compression of the refrigerant in the compressor is isentropic. If there is a suction pressure drop of 0.2 bar, through the valves, and discharge pressure drop through the valve of 0.1 bar, determine the COP of the plant, theoretical piston displacement/min and the heat removed in the condenser. (12)

Contd.....3.

VII. (a) Explain the following:

(i) Effective temperature
(ii) Thermodynamic wet bulb temperature
(iii) By-pass factor.
(iv) Humid specific heat (8)

(b) Atmospheric air at 760mm of Hg barometric pressure has 25°C dry bulb temperature and 15°C wet bulb temperature. Determine (i) relative humidity (ii) humidity ratio (iii) dew point temperature (iv) enthalpy of air per Kg of dry air (v) partial pressure of vapour (vi) saturation temperature corresponding to dry bulb temperature of 25°C, (vii) saturation pressure corresponding to the wet bulb temperature of 15°C (viii) volume of air/Kg of dry air. (12)

OR

VIII. For a summer air conditioning installation for Industrial Application the following data are given:

Room design	- 50% RH - 26°C DBT
Outside design	- 40° DBT - 10% RH
Room sensible heat gain	- 40kW
Room latent heat loss	- 10 kW

The scheme followed is as following:

50% of return air from the room is mixed with outdoor air and precooled sensibly in a cooling coil to 28°C before being passed through adiabatic washer. Determine-

(i) Supply air conditions to the space.

(ii) Quantity of fresh outside air.

(iii) Refrigerating capacity of the precooler coil. (20)

Contd.....4.