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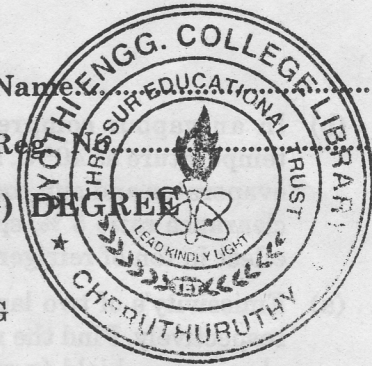
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Name: .....

Reg. No: .....

**THIRD SEMESTER B.TECH. (ENGINEERING) DEGREE  
EXAMINATION, OCTOBER 2011**

EE 09 306 MECHANICAL ENGINEERING  
PTEE 09 305  
(2009 admissions)



Time : Three Hours

Maximum : 70 Marks

**Part A**

*Answer all questions.  
Each question carries 2 marks.*

1. What is the effect of superheating in Rankine cycle ?
  2. State Kirchhoff's law of radiation.
  3. What is meant by LMTD ?
  4. What are the various methods for measuring flow in pipelines ?
  5. What are the hydraulic functions of spiral casing, guide vanes and the draft tube ?
- (5 × 2 = 10 marks)

**Part B**

*Answer any four questions.  
Each question carries 5 marks.*

6. Explain the Brayton's cycle with the help of T-S diagram.
  7. Discuss the methods for improvement of thermal efficiency in Rankine's cycle.
  8. Discuss briefly governing laws of modes of heat transfer.
  9. Explain the concept of driving potential as applied to heat transfer problem.
  10. Explain the principle of venturimeter with a neat sketch. Derive the expression for the rate of flow of fluid through it.
  11. Explain the governing mechanism for Pelton turbine.
- (4 × 5 = 20 marks)

**Part C**

*Answer section (a) or section (b) of each question.  
Each question carries 10 marks.*

12. (a) A steam power plant operates on the reheat Rankine cycle. Steam enters the high pressure turbine at 12.5 MPa and 550° C. at a rate of 7.7 kg./s. and leaves at 2 MPa. Steam is then reheated at constant pressure to 450° C. before it expands in the low pressure turbine. The isentropic efficiencies of the turbine and pump are 85 percent and 90 percent, respectively. Steam leaves the condenser as a saturated liquid. If the moisture content of the steam at the exit of the turbine is not to exceed 5 percent, determine (i) the condenser pressure ; (ii) the net power output ; and (iii) the thermal efficiency.

Or

Turn over

- (b) In an vapour compression refrigeration system R22 has condensing and evaporating temperature as  $40^{\circ}\text{C}$ . and  $-20^{\circ}\text{C}$ . respectively. The refrigerant is superheated to  $0^{\circ}\text{C}$ . in the evaporator and sub cooled by  $10^{\circ}\text{C}$ . in the condenser. The bore and stroke is 100 mm. each, clearance ratio 5 %, speed 600 r.p.m. double acting, 2 cylinder. Determine the refrigeration effect in ton of refrigeration and power required.
13. (a) Emissivity's of two large parallel plates maintained at  $800^{\circ}\text{C}$ . and  $300^{\circ}\text{C}$ . are 0.3 and 0.5 respectively. Find the net radiant heat exchanger per square meter of the plates. If a polished aluminium shield ( $\epsilon = 0.05$ ) is placed between them. Find the percentage reduction in heat transfer.

Or

- (b) A counter flow single pass heat exchanger is used to cool the engine oil from  $150^{\circ}\text{C}$ . to  $55^{\circ}\text{C}$ . with water, available at  $23^{\circ}\text{C}$ . as the cooling medium. The specific heat of oil is  $2125\text{ J/kg. K}$ . The flow rate of cooling water through the inner tube of 0.4 m. diameter is  $2.2\text{ kg./s}$ . The flow rate of oil water through the outer tube of 0.75 m. diameter is  $2.42\text{ kg./s}$ . If the value of the overall heat transfer coefficient is  $240\text{ W/m}^2\text{K}$ , how long must the heat exchanger be to meet its cooling requirement ?
14. (a) A simple U-tube manometer containing mercury is connected to a pipe in which an oil of specific gravity 0.8 is flowing. The pressure in the pipe is vacuum. The other end of the manometer is open to the atmosphere. Find the vacuum, pressure in pipe, if the difference of mercury level in the two limbs is 20 cm. and height of oil in the left limb from the centre of the pipe is 15 cm. below.

Or

- (b) A venturimeter is used for measurement of discharge of water in horizontal pipeline. If the ratio of upstream pipe diameter to that of throat is 2 : 1, upstream diameter is 300 mm., the difference in pressure between throat and upstream is equal to 3 m. head of water and loss of head through meter is one-eighth of the throat velocity head, calculate the discharge in the pipe.
15. (a) (i) Draw and discuss the operating characteristics of a centrifugal pump. (5 marks)  
 (ii) Define specific speed of a centrifugal pump. Derive an expression for the same. (5 marks)

Or

- (b) A Pelton wheel has a mean bucket speed of  $35\text{ m/s}$ . with a jet of water flowing at the rate of  $1\text{ m}^3/\text{s}$  under a head of 270 m. The buckets deflect the jet through an angle of  $170^{\circ}$ . Calculate the power delivered to the runner and the hydraulic efficiency of the turbine. Assume coefficient of velocity as 0.98.

[4 × 10 = 40 marks]