Tanta University

Department: Mechanical Power Engineering

Faculty of Engineering

Total Marks 65

Course Title: Advanced Combustion Engineering	Course Code : MEP 624	Graduate Students
Date: June 9th 2016 (second Term)	Allowed Time : 3 hrs	No. of Pages: (2)

Remarks: (Answer all the following questions, Assuming any missing data)

Problem number (1) (30 Marks)

A. What are the stages of combustion process in SI Engine: support your answer with suitable drawing. **10 Marks**

B. Briefly explain with suitable drawing the factor affecting the flame propagation in SI engine. **5 Marks**

C. Identify the stages of combustion in compression ignition engine? **5 Marks**

D. Explain briefly with suitable drawing the factors affecting on the ignition delay period in CI engine? And explain with suitable drawing the phenomenon of knocking in CI engine, its reasons, how can be controlled? **10 Marks**

Problem number (2) (35 Marks)

A. The combustion process in spark-ignition and compression-ignition engines can develop cycle-to-cycle variations when operating conditions reach some fundamental limit. These variations may lead to both reduced output power and higher emissions. What are the fundamental cause of the engine cyclic variation and how we can determine the variation quantity? Finally what are the engine operating conditions that physically effect the cycle to cycle variation? **10 Marks**

B. Advanced compression-ignition (CI) engines can deliver both high efficiency and very low NO_X and particulate (PM) emissions. Suggest with suitable explanation and drawing two methods that can be used to accomplish the advanced CI engine? **10 Marks**

C. What are the basic requirements of a good combustion chamber? And briefly explain with suitable drawing the different types of combustion chambers in both SI, and CI engine? **15 Marks**

With my best wishes:

Prof. Dr. Eng. Medhat Elkelawy ..... and committee

Tanta University
Faculty of Engineering JUNE 2016 MEP611
Mechanical Power Engineering Dept.

PHD Exam
Heat Exchanger
Time 3h

Attempt solve the following heat transfer table are allowed

Question (1)

a) Write the Classification of heat exchangers

b) A water preheated consists of an iron pipe (k=59 W/m K)) with an I.D of 3`.175 cm and a wall thickness of 180 ° C. The water flows through thepipe with a velocity of 1.22 m/s The heat transfer coefficient on the steam side is 11300 W/m²K.

(a) Calculate the length of the pipe required to heat water from 30 to 90 °C.

(b) If the water enters this pipe at a temperature of 150 ° C. What will be its outlet temperature?. if all condition and length of tube are the same in a.

Question (2)

A hot water at 71 ° C is used to heat 3955kg/h of fuel from 10 to 20 ° C. the hot water flows with a velocity of 0.76 m/s through a copper tube(2.13 bet cm O.D. and 1.86 cm I.D.). the oil is pumped through the annulus between the copper tube and steel pipe(3.34cm O. D. and 3.0cm I.D.). What length of the counter flow heat exchanger is required?

Take the properties of water and oil are

property	Water	Oil
Cp kJ/kg K	4.187	1.884
K W/m K	0.657	0.788
ν m^2/S	4.18×10^{-7}	0.743×10^{-5}
ρ kg/m^3	988	854

Question (3)

A heated oil enters a heat exchanger at 160 ° C to cooled by water entering at 35 ° C.. if the two fluid flow in parallel flow the exit temperature of oil and water a water 90 °C determine

1) Exit temperature of oil and water flow if the two fluids are in counter to each other

2) Lowest temperature to which oil could be cooled in parallel flow and counter flow

Question (4)

A plane plate extended surface cooler for air consists of 17/20 mm copper tubing, with 1 mm thick plain aluminium fins with fixed on the outside of tube at a spacing of 10 mm. distance between pipe is 60 mm. the inside and outside heat transfer coefficient are Hi= 3600 W/m² K and ho = 32.5 W/m² K the refrigerant and air side temperature are ti=-25 ° C and to=-20 ° C find the outside tube surface area and tube length for a heat exchange of 2.72 kW. The thermal conductivity of aluminium is 200 W/m K. assume the fin efficiency equal of that a rectangular fins

Question (5)

Write the algarithem of solution of any problem contain the heat exchanger and develop the flow chart or step of solution using any soft were

Remarks: (answer the following questions; assume any missing data, steam and heat tables and charts are allowed)

Problem number (1) (18 Marks)

a) A 3-m internal diameter spherical tank made of 2-cm-thick stainless steel (k = 15 W/m·K) is used to store iced water at $T_{\infty 1}$ = 0 °C. The tank is located in a room whose temperature is $T_{\infty 1}$ = 22 °C. The walls of the room are also at 22 °C. The outer surface of the tank is black and heat transfer between the outer surface of the tank and the surroundings is by natural convection and radiation. The convection heat transfer coefficients at the inner and the outer surfaces of the tank are h_1 = 80 W/m²·K and h_2 = 10 W/m²·K, respectively. Determine (*a*) the rate of heat transfer to the iced water in the tank and (*b*) the amount of ice at 0°C that melts during a 24-h period. **(10 Marks)**

b) A 5 -m-long section of hot- and cold-water pipes run parallel to each other in a thick concrete layer. The diameters of both pipes are 5 cm, and the distance between the centerline of the pipes is 30 cm. The surface temperatures of the hot and cold pipes are 70°C and 15°C, respectively. Taking the thermal conductivity of the concrete to be k = 0.75 W/m·K, determine the rate of heat transfer between the pipes. **(8 Marks)**

Problem number (2) (18 Marks)

a) Steam in a heating system flows through tubes whose outer diameter is D_1= 3 cm and whose walls are maintained at a temperature 0f 120 °C. Circular aluminium fins (k = 180 W/m. °C) of outer diameter D_2 = 6 cm and constant thickness t =2 mm are attached to the tube, the space between the fins is 3 mm, and thus there are 200 fins per meter length of the tube. Heat is transferred to the surrounding air at T_a = 25 °C, with a combined heat transfer coefficient of h = 60 W/m². °C. Determine the increase in heat transfer from the tube per meter of its length as a result of adding fins. **(9 Marks)**

b) In a production facility, large brass plates of 4-cm thickness that are initially at a uniform temperature of 20°C are heated by passing them through an oven that is maintained at 500°C. The plates remain in the oven for a period of 7 min. Taking the combined convection and radiation heat transfer coefficient to be h = 120 W/m²·K, determine the surface temperature of the plates when they come out of the oven. (9 Marks)

P.T.O.

Problem number (3) **(19 Marks)**

a) Water is to be heated from 15 °C to 65 °C as it flows through a 3-cm-internal diameter 5-m-long tube. The tube is equipped with an electric resistance heater that provides uniform heating throughout the surface of the tube. The outer surface of the heater is well insulated, so that in steady operation all the heat generated in the heater is transferred to the water in the tube. If the system is to provide hot water at a rate of 10 L/min, determine the power rating of the resistance heater. Also, estimate the inner surface temperature of the tube at the exit.

(10 Marks)

b) A long 10 -cm-diameter steam pipe whose external surface temperature is 110 °C passes through some open area that is not protected against the winds. Determine the rate of heat loss from the pipe per unit of its length when the air is at 1 atm pressure and 10 °C and the wind is blowing across the pipe at a velocity of 8 m/s. **(9 Marks)**

Problem number (4) **(10 Marks)**

a) How does the mass diffusivity of a gas mixture change with (a) temperature and (b) pressure?

(4 Marks)

b) Determine the mole fraction of air dissolved in water at the surface of a lake whose temperature is 17°C. Take the atmospheric pressure at lake level to be 92 kPa. **(6 Marks)**

With my best wishes

EXAMINER DR. ELSAYED ELSAID

<table>
<tr><td rowspan="3"></td><td colspan="3">TANTA UNIVERSITY
FACULTY OF ENGINEERING
DEPARTMENT OF MECHANICAL POWER ENGINEERING</td></tr>
<tr><td colspan="3">EXAMINATION FOR FRESHMEN (2016 YEAR),</td></tr>
<tr><td>COURSE TITLE:</td><td>Industrial Furnaces and Boilers</td><td>COURSE CODE: MEP525</td></tr>
<tr><td>DATE:</td><td>June 5, 2016</td><td>TERM: 2nd | TOTAL ASSESSMENT MARKS: 65</td><td>TIME ALLOWED (HOURS): 3</td></tr>
</table>

Answer the following questions.

Question (1) (20 Marks)

1- Mention the different possible classifications of generators? Discus Classification According to furnace pressure?

2- Describe using drawing the circulation of water? What are the advantages of forced circulation over natural circulation?

Question (2) (18 Marks)

1- Mention the components of water-tube generators?

2- Discus the phenomenon of film boiling? What are the quantities that condition the occurrence of this phenomenon?

3- How to control the temperature of the superheated steam?

Question (3) (12 Marks)

1- Mention the different heat losses in the boiler?

2- The following observations were recorded during a boiler trial.

Mass of feed water	=640 kg/hr
Temperature of feed water	=50 °C
Steam pressure	=10 bar
Fuel used	=55 kg/hr
H.C.V. of fuel	= 44100 kJ/kg
Temperature of flue gases	=300 °C
Boiler room temperature	= 30 °C
Heating surface of the boiler	=18.6 m^2
Mass of gases	=17.95 kg/kgf

Cp (dry flue gases) = 1.09 kJ/kg °C

Find:

Efficiency of the boiler

Question (4) (15 Marks)

1- What is a furnace? Where are furnaces used?

2- Describe in details using drawing the improved efficiency of

a- Glass furnace

b- a mixed feed vertical shaft lime kiln

EXAMINERS	Dr. Magda El-Fakharany	

Best wishes

Tanta University **Faculty of Engineering** **Mech. Power Eng. Dept.**

Questions for the PG Exam (MSc)

Subject: Hydraulic Power Systems (Code 627) Date: 05/06/2016

Examiner: Dr. M. Khalil Kamel Time: 3 hrs.

Attempt All Questions Number of questions: 4 Number of Pages: 1

Question (1)

a- Compare between the four different power systems.

b- Define the hydraulic power systems.

c- What are the advantage and disadvantage of hydraulic systems?

Question (2)

a- Analyze both ideal and real pumps.

b- Classify of displacement pumps.

Question (3)

State the principle of operation, advantage & disadvantage, and scheme of the following:

- Flow control valve.
- Non-return valve.
- Directional control valve.
- Pressure control valve.

Question (4)

a- Explain in details the hydraulic tubing.

b- Hoses are used to interconnect elements, Explain.

c- Discus the pressure and power losses in hydraulic conduits.

Good Luck

Tanta University		Department: Mechanical PowerEngineering	Faculty of Engineering
Course Title:Steam Power Stations		Course Code: MEP 519	Post graduate
Date: January, 7– 6– 2016	Allowed time: 3 hrs	Full Marks: 65	No of Pages: 2
Name: Dr. Mohamed AbdElgaied Ahmed			Final Exam

Answer the following questions: Assume any necessary assumptions. **Marks**

Question No. 1 (15)

a) Discuss the classification of impulse steam turbine.

b) In an impulse steam turbine, steam is accelerated through nozzle from rest. It entersthe nozzle at 9.8 bar dry and saturated. The height of the blade is 10 cm and the nozzle angle is 15°.Mean blade velocity is 144 m/s. The blade velocity ratio is 0.48 and blade velocity coefficient is 0.97.Find:

(1) Isentropic heat drop.

(2) Energy lost in the nozzles and in moving blades due to friction.

(3) Energy lost due to finite velocity of steam leaving the stage.

(4) Mass flow rate.

(5) Power developed per stage.

(6) Diagram and stage efficiency. Take: Nozzle efficiency = 92%

Blade angles at inlet = Blade angles at out let Speed = 3000 rev/min

Question No. 2 (10)

A reaction steam turbine runs at 300 rev/min and its steam consumption is 16500kg/hr. The pressure of steam at a certain pair is 1.765 bar (abs.) and its dryness fraction is 0.9. And thepower developed by the pair is 3.31 kW. The discharge blade tip angel both for fixed and moving bladeis 20° and the axial velocity of flow is 0.72 of the mean moving blade velocity. Find the drum diameterand blade height. Take the tip leakage as 8%, but neglect area blocked by blade thickness.

Question No. 3 (15)

(i) Steam at 15 bar and 350 °C is expanded through a 50% reaction turbine to a pressure of 0.14 bar. The stage efficiency is 75% for each stage, and the reheat factor is 1.04. The expansion is to be carried out in 20 stages and the diagram power is required to be 12 000 kW. Calculate the flow of steam required, assuming that the stages all develop equal work.

(ii) In the turbine above at one stage the pressure is 1 bar and the steam is dry saturated.

The exit angle of the blades is 20°, and the blade speed ratio is 0.7. If the blade height is one-twelfth of the blade mean diameter, calculate the value of the mean blade diameter and the rotor speed.

Question No. 4 (13)

Consider the cogeneration plant. Steam enters the turbine at 7 MPa and 500°C. Some steam is extracted from the turbine at 500 kPa for process heating. The remaining steam continues to expand to 5 kPa. Steam is then condensed at constant pressure and pumped to the boiler pressure of 7 MPa. At times of high demand for process heat, some steam leaving the boiler is throttled to 500 kPa and is routed to the process heater. The extraction fractions are adjusted so that steam leaves the process heater as a satu-rated liquid at 500 kPa. It is subsequently pumped to 7 MPa. The mass flow rate of steam through the boiler is 15 kg/s. Disregarding any pressure drops and heat losses in the piping and assuming the turbine and the pump to be isentropic, determine (a) the maximum rate at which process heat can be supplied, (b) the power produced and the utilization factor when no process heat is supplied, and (c) the rate of process heat supply when 10 percent of the steam is extracted before it enters the turbine and 70 percent of the steam is extracted from the turbine at 500 kPa for process heating.

Question No. 5 (12)

At a particular ring of a reaction turbine the blade speed is 67 m/s and the flow of steam is 4.54 kg/s, dry saturated, at 1.373 bar. Both fixed and moving blades have inlet and exit anglesof 35° and 20° respectively.Determine:

(a) Power developed by the pair of rings.

(b) The required blade height which is to be one tenth of the mean blade ring diameter.

(c) The heat drop required by the pair if the steam expands with an efficiency of 80%

****Good luck****

Dr. Mohamed AbdElgaied Ahmed