KATHMANDU UNIVERSITY
End Semester Examination [C]
May/June, 2019

Mark Scored:

Level : B. E.
Year : III

Course : CHEG 303
Semester: I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date 04 JUN 2019

SECTION "A"
[20Q. × 0.5 = 10 marks]

Encircle the most appropriate answer among the given choices.

1. If you were to heat your food in space, what would be the mode of heat transfer?
   a. Conduction
   b. Convection
   c. Radiation
   d. Conduction and convection

2. Newton's Law of Cooling applies to heat transfer by
   a. Conduction
   b. Convection
   c. Radiation
   d. All of the above

3. The temperature difference between the inner and outer surfaces of a spherical shaped vessel is 200 °C. If the resistance to heat transfer and the thermal conductivity of the material are 0.2275 K/W and 0.0833 W/m.°C respectively, what is the rate of heat transfer?
   a. 879.132 W b. 2079.12 W c. 583.21 W d. 1541.56 W

4. It is desirable to operate many engineering devices in the _____ boiling regime.
   a. Nucleate
   b. Film
   c. Transition
   d. None of the above

5. The thermal resistance for one-dimensional conductive heat transfer through a flat plane is _____ and through a cylindrical object is _____?
   a. Exponential and Linear
   b. Linear and Logarithmic
   c. Logarithmic and Polynomial
   d. Exponential and Logarithmic

6. Heat transfer coefficient is maximum for which flow?
   a. Turbulent b. Laminar c. Creeping d. Transition

7. The amount of heat transferred by a single fin is 747 watts. If an engine is 8.5 kW in size, is 30% efficient in transferring power (i.e. the other 70% is lost as heat) and 80% of the lost heat is transferred by the fins, how many fins are needed?
   a. 5 b. 6 c. 7 d. 8

8. Which of the following is NOT an example of conduction?
   a. Burning yourself on a hot stove
   b. A Styrofoam cooler slowly gaining heat from surrounding on a hot day
   c. The warmth you feel when you hold a hot water bottle
   d. The cold feeling when you step on a cold tile floor

9. For radiation exchange between 3 surfaces, how many view factors need to be determined directly?
   a. 3 b. 4 c. 5 d. 6

10. For external forced convection over a flat plate, the critical Reynolds number corresponding to the onset of turbulence is
a. 2300 b. 4000 c. 500000 d. 10000

11. For clean and uncontaminated surfaces, condensation occurs by
a. Film formation
b. Droplets formation
c. Fog formation
d. Both (a) and (b)

12. In radiation, a surface which is large relative to all other surfaces under consideration can be treated as if it were a
a. Gray body b. Black body c. Red body d. Green body

13. Baffles increase the convection coefficient of the _____ fluid of a heat exchanger.
a. Tube side only
b. Shell side only
c. Both shell and tube side
d. None of the above

14. Radiation emitted by a black body is independent of
a. Wavelength b. Temperature c. Direction d. All of the mentioned

15. Consider a large isothermal enclosure that is maintained at a uniform temperature of 2000 K. Calculate the emissive power of the radiation that emerges from a small aperture on the enclosed surface. The Stefan-Boltzmann constant is 5.67×10^{-8} W/m^2.K^4
a. 9×10^5 W/m^2 b. 5×10^5 W/m^2 c. 10^6 W/m^2 d. 6×10^6 W/m^2

16. According to Kirchhoff's law, any surface in a large isothermal enclosure has
a. Emissivity equal to absorptivity
b. Emissivity equal to transmissivity
c. Absorptivity equal to transmissivity
d. Emissivity, absorptivity and transmissivity are all equal

17. For a plane or convex surface, the view factor F_{ii} which is defined as the radiation that leaves the surface i and is directly intercepted by i is
a. 1 b. 3 c. 0 d. 5

18. Water flows at the rate of 65 kg/min through a double pipe counter flow heat exchanger. Water is heated from 50 °C to 75 °C by an oil flowing through the tube. The specific heat of the oil and water are 1.780 kJ/kg.K and 4.186 kJ/kg.K respectively. If the oil enters and leaves at 115 °C and 70 °C respectively, what is the rate of heat transfer?
a. 110 kW b. 113 kW c. 116 kW d. 120 kW

19. For the problem in 18, what is the log mean temperature difference?
a. 26.8 °C b. 27.8 °C c. 28.8 °C d. 29.8 °C

20. For the problem in 18, if the overall heat transfer coefficient is 340 W/m^2.K, what is the area of the heat exchanger?
a. 15.8 m^2 b. 11.5 m2 c. 10.4 m^2 d. 18.8 m^2

KATHMANDU UNIVERSITY
End Semester Examination [C]
May/June, 2019

04 JUN 2019

Level : B. E.
Year : III
Time : 2 hrs. 30 mins.

Course : CHEG 303
Semester: I
F. M. : 40

SECTION "B"
[4Q. × 10 = 40 marks]

Attempt *ANY FOUR* questions.

1. Aluminum pin fins of parabolic profile with blunt tips are attached on a plane wall of surface temperature 200 °C. Each fin has a length of 20 mm and a base diameter of 5 mm. The fins are exposed to an ambient air condition of 25 °C and the convection heat transfer coefficient is 50 $W/m^2.K$. Taking $I_0(x)$ and $I_1(x)$ values as 1.0350 and 0.1716, determine
   a) The efficiency of each fin [4]
   b) Heat transfer rate of each fin [3]
   c) Effectiveness of each fin [3]

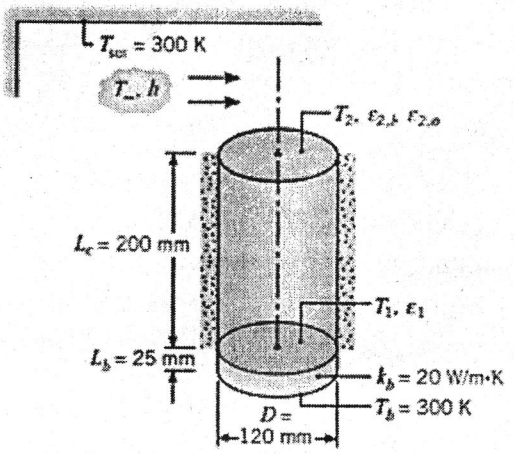
2. A cylindrical stainless steel vessel (k = 15 W/m·K) with an inside diameter of 1 meter and 0.1 meter thick walls is full of radioactive material (k = 80 W/m·K) which generates energy at a rate of 2×10^5 W/m^3. The vessel is submerged in a bath of water, which is maintained at 25°C. The convective heat transfer coefficient between the vessel and water is 1000 $W/m^2 \cdot K$. The ends of the cylindrical vessel are capped and very well insulated so that heat transfer through the ends is negligible. Assume a length basis of 1 m for the cylindrical vessel. If the system is at steady state, determine the temperatures
   a) At the outer surface of the vessel wall [3]
   b) At the inner surface of the vessel wall [3]
   c) At the center of the radioactive material [4]

3. Hot oil is to be cooled by water in a 1 shell pass and 8 tube passes heat exchanger. The tubes are thin walled and are made of copper with an internal diameter of 1.4 cm. The length of each tube pass in the heat exchanger is 5 m, and the overall heat transfer coefficient is 310 $W/m^2.K$. Water flows through the tubes at a rate of 0.2 kg/s, and the oil through the shell at a rate of 0.3 kg/s. The water and the oil enter at temperatures of 20 °C and 150 °C respectively. Determine
   a) The rate of heat transfer in the heat exchanger [5]
   b) The outlet temperature of the water [3]
   c) The outlet temperature of the oil [2]

4. Saturated steam at atmospheric pressure condenses on a 2 m high and 3 m wide vertical plate that is maintained at 80 °C by circulating cooling water through the other side. Determine
   a) The heat transfer rate by condensation to the plate [5]
   b) The rate at which the condensate drips off the plate at the bottom [3]
   c) The heat transfer rate if the plate was tilted at 30 °C from the vertical
      Use $h_{inlcine} = h_{vertical} (\cos \theta)^{1/4}$ [2]

5. A metal disc is placed on top of a cylindrical furnace whose bottom surface is electrically heated and whose sidewall may be approximated as reradiating surface. The disc is maintained at T_2= 400 K and the electrically heated surface is maintained at T_1= 800 K. The electrically heated surface is mounted on a ceramic base material of thermal conductivity k = 20 W/m.K. The bottom of the base material as well as the ambient air and large surroundings are maintained at a temperature of 300 K. Emissivities of the heater and the disk inner and outer surfaces are $\varepsilon_1 = 0.9$, $\varepsilon_{2,i} = 0.5$ and $\varepsilon_{2,o} = 0.9$ respectively. Assuming steady state and convection within the cylindrical cavity, determine

a) The electrical power that must be supplied to the heater [5]
b) The convection coefficient that must be maintained at the outer surface of the disk [5]



6. Consider the flow of oil at 20°C in a 30-cm-diameter pipeline at an average velocity of 2 m/s. A 200-m-long section of the pipeline passes through icy waters of a lake at 0°C. Measurements indicate that the surface temperature of the pipe is very nearly 0°C. Disregarding the thermal resistance of the pipe material, determine

a) The temperature of the oil when the pipe leaves the lake [4]
b) The rate of heat transfer from the oil [3]
c) The pumping power required to overcome the pressure losses and to maintain the flow of the oil in the pipe [3]

The pressure drop in the pipe for laminar flow is given by

$$f = \frac{64}{Re}\frac{L}{D}\frac{\rho V_m^2}{2}$$

KATHMANDU UNIVERSITY
End Semester Examination [C]
May/June, 2019

Mark Scored:

Level : B.Sc.
Year : III

Course : MATH 322
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date 04 JUN 2019

SECTION "A"
[10 Q. × 1 = 10 marks]

Fill in the blank space(s) by writing most appropriate word(s) or symbols(s).

1. The domain of the ceiling function is .....

2. The generating function for the sequence 1, - 2, 4, - 8, ..., is $f(x)$ = ...

3. The evaluation of the Boolean expression $\sim [(a \leq b) \wedge (b > c)]$ for a = 5, b = 7 and c = 6, is .....

4. A function on a set is ..... operation.

5. The recurrence relation for the sequence 3, 7, 11, 15, 19, ..., is .....

6. $\lfloor -279.35 \rfloor$ = ...

7. The gcd(a, b) is the ..... positive integer which can be written as the linear combination of a and b.

8. Every group of prime order is .....

9. The subgroup H of a group G defined by $H = \{a \in G: ag = ga \text{ for all } g \text{ in } G\}$ is ..... of G.

10. A commutative ring with unity is an integral domain that it has no proper ..... of zero.

SECTION "B"
[10 Q. × 1 = 10 marks]

Fill in the blank space(s), **DO NOT TICK**, by choosing the most appropriate answer from among the given ones.

11. The number of solutions of the equation $c_1 + c_2 + c_3 = 5$ with non-negative integer variables c_1, c_2, c_3, is ....
[15; 17; 21; 23]

12. For real function $f(x) = 3x + 7$, the value of $f^3(-3)$ is ... .
[- 10; - 8 ; 8; 10]

13. For any three positive integers a, b, c, the Diophantine equation $ax + by = c$ has ..... solution $x = x_0$, $y = y_0$ if gcd(a, b) divides c.
[natural; integer; rational; real]

14. The coefficient of a^2b^2 in the expansion of $(2a - 3b)^4$ is .....
[96; 208; 216; 224]

15. The relation $b_{n+1} = 3\ b_n + 2\ b_{n-1} - 5\ b_{n-2}$ is a linear homogeneous recurrence relation with constant coefficient of order .....
[1; 2; 3; 4]

16. If h is the mod-11 function, then h(1732) = ...
[3; 4; 5; 6]

17. The number of one to one functions from A to B with n(A) = 3 and n(B) = 5, both and B being non empty sets, is .....
[50; 55; 60; 65]

18. For positive integers a and b with a = 231, gcd(a, b) = 7 and lcm(a, b) = 60060, the value of b is .....
[1818; 1820; 1822; 1824]

19. The number of prime less than or equal to 100 is ....
[21; 23; 25; 27]

20. The number of words of three distinct letters from the letters of the words "KUCS" is .....
[16; 20; 24; 28]