الاسم الرباعي:

الرقم السري:

جامعة تكريت

كلية الهندسة

قسم الهندسة الميكانيكية

الوقت: ثلاث ساعات

الرقم السري: ....

الامتحان التنافسي للتقديم للدراسات العليا

للعام الدراسي 2024/2023

(الدكتوراه)

يوم الثلاثاء المصادف

2023/6/20

ملاحظات:

1- ضع دائرة حول الاجابة الصحيحة للأسئلة الاختيارية.

2- جميع الاسئلة لها نفس الدرجة.

3- عدد الأسئلة 65 سؤالا.

لجنة الدراسات العليا

قسم الهندسة الميكانيكية

وزارة التعليم العالي و البحث العلمي

جامعة تكريت

كلية الهندسة

القسم: الميكانيك

الدراسة: الدكتوراه

التاريخ: 2023/6/20

الامتحان التنافسي للتقديم للدراسات العليا للعام الدراسي 2023-2024

رقم السؤال	الإجابة (تؤشر بصح او خطأ)	الدرجة	اسم وتوقيع المصحح	رقم السؤال	الإجابة (تؤشر بصح او خطأ)	الدرجة	اسم وتوقيع المصحح
1				34			
2				35			
3				36			
4				37			
5				38			
6				39			
7				40			
8				41			
9				42			
10				43			
11				44			
12				45			
13				46			
14				47			
15				48			
16				49			
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25				58			
26				59			
27				60			
28				61			
29				62			
30				63			
31				64			
32				65			
33				66			

الدرجة النهائية	رقماً	كتابة	اسم وتوقيع المدقق

1- If $t = m^2$ then the transformation the integral $\int_0^\infty e^{-t} t^{x-1} dt$ from t domain the m domain yields

$(a) -$ $2\int_0^\infty e^{-m}\, m^{2x-1} dm$

$(b) -$ $2\int_0^\infty e^{-m^2} m^{2x-1} dm$

$(c) -$ $2\int_0^\infty e^{-m}\, m^{x-1} dm$

$(d) -$ $2\int_0^\infty e^{-m^2}\, m^{x-1} dm$

2- The functions in the interval [a, b]of an **orthonormal** set $\{\phi_n(x)\}$ have the property that

$(a) -$ $\int_a^b \phi_n(x)\, \phi_n(x) dx = \sqrt{2}$, $\int_a^b \phi_n(x)\, \phi_m(x) dx = 0$

$(b) -$ $\int_a^b \phi_n(x)\, \phi_n(x) dx = 1$, $\int_a^b \phi_n(x)\, \phi_m(x) dx = \sqrt{2}$

$(c) -$ $\int_a^b \phi_n(x)\, \phi_n(x) dx = 0$, $\int_a^b \phi_n(x)\, \phi_m(x) dx = 1$

$(d) -$ $\int_a^b \phi_n(x)\, \phi_n(x) dx = 1$, $\int_a^b \phi_n(x)\, \phi_m(x) dx = 0$

3- The differential equation $y'' + \lambda y = 0$ satisfies the boundary conditions $y(0) = 0$ and $y(\pi) - y'(\pi) = 0$ if

$(a) -$ $\lambda = 0$

$(b) -$ $\lambda < 0$

$(c) -$ $\lambda > 0$

$(d) -$ No one above

4- Transform the counter of this summation $\sum_{m=n}^{m=\infty} \frac{(-1)^m x^{2m-n}}{2^{2m-n} m!\ (m-n)!}$ from m to k so that $\sum_{k=0}^{\infty}$.......

5- Prove that

$$J_{\nu-1}(x) = \frac{2\nu}{x} J_{\nu}(x) - J_{\nu+1}(x$$

Where J_ν is Bessel Function of first kind of order ν

Hint

$$\frac{d}{dx}[x^{\nu}J_{\nu}(x)] = x^{\nu}J_{\nu-1}(x) \quad \cdots\cdots\cdots (1) \quad ; \quad \frac{d}{dx}[x^{-\nu}J_{\nu}(x)] = -x^{-\nu}J_{\nu+1}(x) \quad \cdots\cdots\cdots (2$$

6- For a linear elastic material that is completely incompressible, the Poisson's ratio is-----

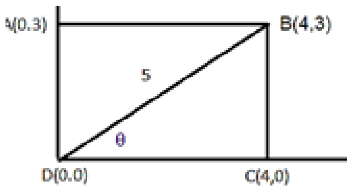
$(a) -$ 0.35

$(b) -$ 0.5

$(c) -$ 0

$(d) -$ infinity

7- Plane strain is being applied to a rectangular section of the solid. The original rectangle has four corners at (0,0), (4,0), (4,3), and (0,3). Both the x- and y-axis strains are $\varepsilon_{xx} = 0.001$ and $\varepsilon_{yy} = 0.002$. For a distorted and stretched diagonal of length 0.014, the value of shear strain γxy, rounded to three decimal places, is given in ------ units



8- At a point in a critical section of a machine component, the principal stresses are σ_1= 60 MPa, σ_2 = 5 MPa, and σ_3 = -40 MPa. The tensile yield strength of the component's material is σ_y = 200 MPa. According to the theory of maximal shear tension, the safety factor is ---------.

$(a) -$ 1.5

$(b) -$ 3

$(c) -$ 2.25

$(d) -$ 2

9- When a cube of length L is subjected to equal compressive stresses in the X, Y, and Z directions, what is the volume change as a function of Young's modulus and Poisson's ratio?

10- An aluminum alloy has a yield stress of 50 MPa in uniaxial tension. If the material is subjected to stresses $\sigma 1$ = 25 MPa, $\sigma 2$ = 15 MPa, and $\sigma 3$ = -26 MPa in a three-dimensional state of stress, will it yield according to the distortion energy criterion? Provide an explanation for your answer.

11- Which of the following is the resultant diameter of a solid steel spheroid when exposed to a hydrostatic pressure of 5 * 10^9 Pas? The spheroid has a diameter of 20 mm at first. The Young's modulus is 200 GPas, and the Poisson's ratio is 0.30.

$(a)-$ 17.89 mm

$(b)-$ 18.76 mm

$(c)-$ 19.80 mm

$(d)-$ 16.79 mm

12- In the field of elasticity, the connection between Young's modulus (E), shear modulus (G), and bulk modulus (K) is -----

$(a)-$ $E = \frac{9KG}{(K+3G)}$

$(b)-$ $E = \frac{9KG}{(3K+G)}$

$(c)-$ $E = \frac{3KG}{(9K+G)}$

$(d)-$ $E = \frac{3KG}{(K+9G)}$

13- The given displacement field in a body is specified as u = $(x^2+3) *10^{-3}$, v = $3y^2 z *10^{-3}$, and w = $(x + 3z) *10^{-3}$. At a point with coordinates (1,2,3), the strain component γ_{yz} is ----- ------.

14- The strain components at a point are given $\varepsilon_x = 0.01$, $\varepsilon_y = -0.02$, $\varepsilon_z = 0.03$, $\gamma_{xy} = 0.015$, $\gamma_{yz} = 0.02$, $\gamma_{xz} = -0.01$. The normal strain on the octahedral plane is ------------.

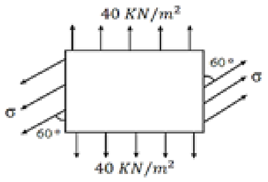
$(a)-$ 0.102

$(b)-$ 0.015

$(c)-$ 0.017

$(d)-$ 0.011

15- At a specific point in a strained material, when exposed to the stresses depicted in the figure, the major principal stress σ_1 has a value of 97.23 kN/m^2.



The stress value, denoted by σ, is ------------ expressed in units of kN/m^2.

$(a) -$ 78 kN/m^2

$(b) -$ 18 kN/m^2

$(c) -$ 80 kN/m^2

$(d) -$ 92 kN/m^2

16- If the equations of motion of a two degree of freedom system are given by

$$\begin{bmatrix} 3m & 0 \\ 0 & 2m \end{bmatrix} \begin{Bmatrix} \ddot{x}_1 \\ \ddot{x}_2 \end{Bmatrix} + \begin{bmatrix} 3k & -k \\ -k & 2k \end{bmatrix} \begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix} = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$$

Find the natural frequencies of the system

17- If the mass and stiffness matrices for the two-degree-of-freedom system are given by

$$\mathbf{M} = m\begin{bmatrix}1 & 0\\0 & 2\end{bmatrix}, \qquad \mathbf{K} = k\begin{bmatrix}2 & -1\\-1 & 3\end{bmatrix}$$

and corresponding modal matrix are

$$\phi_1 = \begin{bmatrix}1\\1\end{bmatrix} \quad , \quad \phi_2 = \begin{bmatrix}1\\-0.5\end{bmatrix}$$

Then the orthonormal modes are

$(a) -$ $\frac{1}{\sqrt{m}}\begin{bmatrix}\sqrt{\frac{2}{3}}\\\sqrt{\frac{2}{3}}\end{bmatrix}$, $\frac{1}{\sqrt{m}}\begin{bmatrix}\sqrt{\frac{2}{3}}\\-\sqrt{\frac{2}{3}}\end{bmatrix}$

$(b) -$ $\frac{1}{\sqrt{m}}\begin{bmatrix}\frac{1}{\sqrt{3}}\\\frac{1}{\sqrt{3}}\end{bmatrix}$, $\frac{1}{\sqrt{m}}\begin{bmatrix}\sqrt{\frac{2}{3}}\\-\sqrt{\frac{2}{12}}\end{bmatrix}$

$(c) -$ $\frac{1}{\sqrt{m}}\begin{bmatrix}\sqrt{3}\\\sqrt{3}\end{bmatrix}$, $\frac{1}{\sqrt{m}}\begin{bmatrix}\sqrt{\frac{3}{2}}\\-\sqrt{\frac{3}{1}}\end{bmatrix}$

$(d) -$ $\frac{1}{\sqrt{m}}\begin{bmatrix}1\\1\end{bmatrix}$, $\frac{1}{\sqrt{m}}\begin{bmatrix}2\\-2.5\end{bmatrix}$

18- If the mass and stiffness matrices for the two-degree-of-freedom system are given by

$$\mathbf{M} = m\begin{bmatrix}2 & 0\\0 & 1\end{bmatrix}, \qquad \mathbf{K} = k\begin{bmatrix}3 & -1\\-1 & 1\end{bmatrix}$$

and corresponding orthonormal modal matrix are

$$\phi_1 = \frac{1}{\sqrt{m}}\begin{bmatrix}0.4082\\0.8165\end{bmatrix} \quad , \quad \phi_2 = \frac{1}{\sqrt{m}}\begin{bmatrix}-0.5774\\0.5774\end{bmatrix}$$

Then the natural frequencies of the system are

$(a) -$ $\omega_1 = 0.909\sqrt{\frac{k}{m}}$, $\omega_2 = 2.35\sqrt{\frac{k}{m}}$

$(b) -$ $\omega_1 = 1.00\sqrt{\frac{k}{m}}$, $\omega_2 = 4.21\sqrt{\frac{k}{m}}$

$(c) -$ $\omega_1 = 0.707\sqrt{\frac{k}{m}}$, $\omega_2 = 1.414\sqrt{\frac{k}{m}}$

$(d) -$ $\omega_1 = 1.10\sqrt{\frac{k}{m}}$, $\omega_2 = 3.20\sqrt{\frac{k}{m}}$

19- If the mass and stiffness matrices for the two-degree-of-freedom system are given by

$$\mathbf{M} = m\begin{bmatrix}1 & 0\\0 & 2\end{bmatrix}, \quad \mathbf{K} = k\begin{bmatrix}2 & -1\\-1 & 3\end{bmatrix}$$

and corresponding orthogonal modal matrix are

$$\phi_1 = \begin{bmatrix}1\\1\end{bmatrix} \quad , \quad \phi_2 = \begin{bmatrix}1\\-0.5\end{bmatrix}$$

Check the orthognality condition of normal modes with respect to stiffness matrix

20- If $k_1 = k_2 = k_3 = k$, then the stiffness matrix of the system shown in Figure (1) is

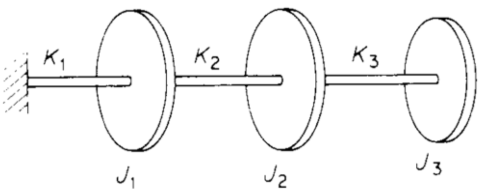


Figure (1)

$(a) -$ $$k\begin{bmatrix}1 & -1 & 0\\-1 & 1 & -1\\0 & -1 & 1\end{bmatrix}$$

$(b) -$ $$k\begin{bmatrix}2 & -1 & 0\\-1 & 2 & -1\\0 & -1 & 1\end{bmatrix}$$

$(c) -$ $$k\begin{bmatrix}2 & -1 & 0\\-1 & 2 & -1\\0 & -1 & 2\end{bmatrix}$$

$(d) -$ $$k\begin{bmatrix}3 & -1 & 0\\-1 & 2 & -1\\0 & -1 & 1\end{bmatrix}$$

21- The rod of mass m which carries the collar of mass m_0 shown in Figure (2) rotates with angular velocity $\dot{\theta}$. If the spring has unstretched length r_0 then the total kinetic energy of the system at the position shown is [neglect the friction between the rod and collar]

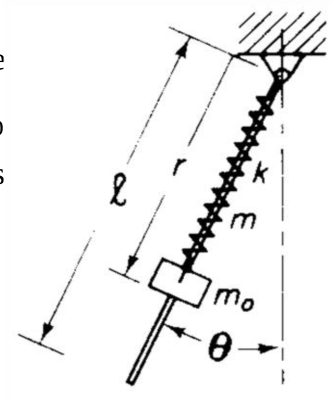


Figure (2)

$(a)-\quad \frac{1}{2}m_0(r\dot{\theta})^2+\frac{1}{2}m(\dot{r})^2$

$(b)-\quad \frac{1}{2}m_0(r\dot{\theta})^2+\frac{1}{2}m_0(\dot{r})^2+\frac{1}{2}(m\frac{l^2}{3})(\dot{\theta})^2$

$(c)-\quad m_0(\dot{r})^2+\frac{1}{2}(m\frac{l^2}{3})(\dot{r})^2$

$(d)-\quad \frac{1}{2}m_0(r\dot{\theta})^2+\frac{1}{2}(m\frac{l^2}{3})(\dot{\theta})^2$

22- The system in Figure (3) of two rods of mass m for each. At the position shown the total potential energy of the system is

$(a)-\quad \frac{1}{2}k(\frac{l}{2}\theta_1)^2$

$(b)-\quad \frac{1}{2}k(\frac{l}{2}\theta_1)^2+mg\frac{l}{2}(1-\cos\theta_1)+mg[l(1-\cos\theta_1)+\frac{l}{2}(1-\cos\theta_2)]$

$(c)-\quad \frac{1}{2}k(\frac{l}{2}\theta_1)^2++mg[l(1-\cos\theta_1)+\frac{l}{2}(1-\cos\theta_2)]$

$(d)-\quad \frac{1}{2}k(\frac{l}{2}\theta_1)^2+mg\frac{l}{2}(1-\cos\theta_1)+mg[l(1-\cos\theta_1)]$

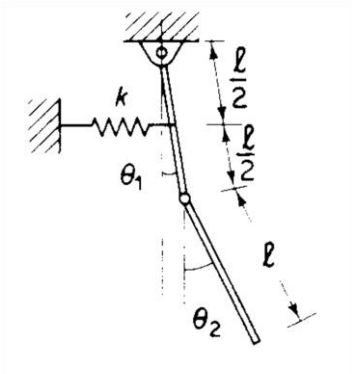


Figure (3)

23- Consider the lateral deflection of beam shown in Figure (4) is $y(x)$. Determine the total potential energy of the beam

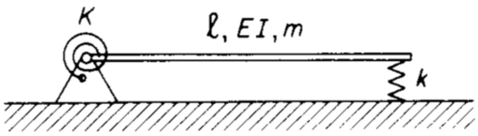


Figure (4)

24- A uniform homogenous beam is fixed at point $x = 0$ and free at point $x = L$, then the four boundary conditions of the beam are

$(a) - \quad y(x,t)|_{x=0} = 0 \; , \quad \left.\frac{\partial y(x,t)}{\partial x}\right|_{x=0} = 0 \; , \quad \left.\frac{\partial^2 y(x,t)}{\partial x^2}\right|_{x=L} = 0 \, , \quad \left.\frac{\partial^3 y(x,t)}{\partial x^3}\right|_{x=L} = 0$

$(b) - \quad y(x,t)|_{x=0} = 0 \; , \quad \left.\frac{\partial y(x,t)}{\partial x}\right|_{x=0} = 0 \; , \quad \left.\frac{\partial^2 y(x,t)}{\partial x^2}\right|_{x=L} \neq 0 \, , \quad \left.\frac{\partial^3 y(x,t)}{\partial x^3}\right|_{x=L} = 0$

$(c) - \quad y(x,t)|_{x=0} = 0 \; , \quad \left.\frac{\partial y(x,t)}{\partial x}\right|_{x=0} = 0 \; , \quad \left.\frac{\partial^2 y(x,t)}{\partial x^2}\right|_{x=L} = 0 \, , \quad \left.\frac{\partial^3 y(x,t)}{\partial x^3}\right|_{x=L} \neq 0$

$(d) - \quad y(x,t)|_{x=0} \neq 0 \; , \quad \left.\frac{\partial y(x,t)}{\partial x}\right|_{x=0} = 0 \; , \quad \left.\frac{\partial^2 y(x,t)}{\partial x^2}\right|_{x=L} \neq 0 \, , \quad \left.\frac{\partial^3 y(x,t)}{\partial x^3}\right|_{x=L} = 0$

25- If a single degree of freedom system is excited by impulsive force at $t = 0$. Then the initial conditions of the system are

$(a) - \quad y_0 = \frac{1}{k} \quad \dot{y}_0 = 0$

$(b) - \quad y_0 = 0 \quad \dot{y}_0 = \frac{1}{m}$

$(c) - \quad y_0 = \frac{1}{m} \quad \dot{y}_0 = 0$

$(d) - \quad y_0 = 0 \quad \dot{y}_0 = \frac{1}{k}$

26- The tendency of a deformed solid to regain its actual proportions instantly upon unloading known as _______________

$(a) -$ Perfectly elastic

$(b) -$ Delayed elasticity

$(c) -$ Inelastic effect

$(d) -$ Plasticity

27- The ability of materials to develop a characteristic behavior under repeated loading known as ___________

$(a) -$ Toughness

$(b) -$ Resilience

$(c) -$ Hardness

$(d) -$ Fatigue

28- Which of the following factors affect the mechanical properties of a material under applied loads?

$(a) -$ Content of alloys

$(b) -$ Grain size

$(c) -$ Imperfection and defects

$(d) -$ Shape of material

29- What type of wear occurs due to an interaction of surfaces due to adhesion of the metals?

$(a) -$ Adhesive wear

$(b) -$ Abrasive wear

$(c) -$ Fretting wear

$(d) -$ Erosive wear

30- Which of the following impurity in cast iron makes it hard and brittle?

$(a) -$ Silicon

$(b) -$ Sulphur

$(c) -$ Manganese

$(d) -$ Phosphorus

31- Brass (alloy of copper and zinc) is an example of

$(a) -$ Substitutional solid solution

$(b) -$ Interstitial solid solution

$(c) -$ Intermetallic compounds

$(d) -$ All of the above

32- In process annealing, the hypo eutectoid steel is

$(a) -$ Heated from 30°C to 50°C above the upper critical temperature and then cooled in still air

$(b) -$ Heated from 30°C to 50°C above the upper critical temperature and then cooled suddenly in a suitable cooling medium

$(c) -$ Heated from 30°C to 50°C above the upper critical temperature and then cooled slowly in the furnace

$(d) -$ Heated below or closes to the lower critical temperature and then cooled slowly

33- Normalising of steel is done to

$(a) -$ Refine the grain structure

$(b) -$ Remove strains caused by cold working

$(c) -$ Remove dislocations caused in the internal structure due to hot working

$(d) -$ All of the above

34- Which of the following statement is wrong?

$(a) -$ Steel with 0.8% carbon is wholly pearlite

$(b) -$ The amount of cementite increases with the increase in percentage of carbon in iron

$(c) -$ A mechanical mixture of 87% cementite and 13% ferrite is called pearlite

$(d) -$ The cementite is identified as round particles in the structure

35- When steel containing less than 0.8% carbon is cooled slowly from temperatures above or within the critical range, it consists of

$(a)-$ Mainly ferrite
$(b)-$ Mainly pearlite
$(c)-$ Ferrite and pearlite
$(d)-$ Pearlite and cementite

36- In lost foam casting, the pattern is

$(a)-$ Low alloy steel
$(b)-$ Grey cast iron
$(c)-$ Polystyrene
$(d)-$

37- Holding furnace of 4 m^3 volume and surface ara of 10 m^2, the modulus is

$(a)-$ 2.5m
$(b)-$ 1.5m
$(c)-$ 0.4m
$(d)-$

38- Zinc flare phenomena means

$(a)-$ zinc melting
$(b)-$ zinc diffusion
$(c)-$ zinc poiling
$(d)-$

39- Entrainment mechanism occurs by

$(a)-$ one action
$(b)-$ two action
$(c)-$ without any action
$(d)-$

40- Double surface film is acted as crack always

$(a) -$ true

$(b) -$ false

$(c) -$ some times

$(d) -$

41- Wetting process during casting is

$(a) -$ harmful

$(b) -$ useful

$(c) -$ some time useful

$(d) -$ sometime harmful

42- Sound casting means

$(a) -$ sand casting

$(b) -$ bimetal casting

$(c) -$ squeeze casting

$(d) -$ free defects casting

43- Shrinkage porosity comes from

$(a) -$ solid film

$(b) -$ partially molten film

$(c) -$ liquid film

$(d) -$

44- Castings without defects can produced when

$(a) -$ rapid flotation of bubbles

$(b) -$ rapid flotation of droplets

$(c) -$ rapid flotation of bifilms

$(d) -$

45- The relationship between density, viscosity, and critical hight is

$(a) -$ $V_c = 2(\gamma g/\rho)^{0.25}$

$(b) -$ $V_c = 2(\gamma g/\rho)^{0.5}$

$(c) -$ $V_c = 2(\gamma g/\rho)$

$(d) -$

46- At the equilibrium state of any system

$(a) -$ entropy of the system becomes maximum

$(b) -$ entropy of the system becomes minimum

$(c) -$ entropy of the system becomes equal to entropy of the surrounding

$(d) -$ none of the above

47- for ideal gas, the less work consuming device occurs during:

$(a) -$ isentropic process

$(b) -$ polytropic process

$(c) -$ isothermal process

$(d) -$ adiabatic process

48- People use electric energy to heat and light homes. What does it indicate?

$(a) -$ People are destroying energy

$(b) -$ People are creating energy

$(c) -$ People are converting energy from more exergy value to less exergy value

$(d) -$ People are converting energy from less exergy value to more exergy value

49- What is the relation between heat rejected by any heat engine (Q_2) and heat rejected by reversible heat engine (Q_{2R}), when both are operating between same heat source and same heat sink?

$(a) -$ $Q_2 = Q_{2R}$

$(b) -$ $Q_2 < Q_{2R}$

$(c) -$ $Q_2 > Q_{2R}$

$(d) -$ cannot say

50- which combination of the following statements is correct?

$(a) -$ A gas cools upon expansion only when its Joule-Thompson coefficient is positive in the temperature range of expansion.
$(b) -$ A liquid expands upon freezing when the slope of its fusion curve on pressure-temperature diagram is negative
$(c) -$ The work done by closed system in an adiabatic process is a point function.
$(d) -$ At the equilibrium state of any system, entropy of the system becomes maximum.

51- Consider heat gain is occurring in a system at temperatures T from the surrounding at temperature T_o . If T_o is greater than T, then the exergy of the system will

$(a) -$ increases
$(b) -$ decreases
$(c) -$ remains constant
$(d) -$ couldn't be predicted

52- A heat engine is supplied with 100 kJ/s of heat at a fixed temperature of 250°C. if 50 kJ/s are rejected at 10°C, the cycle is………………….

53- The source of exergy in Turbine is……………………..…and in heat exchanger is……………………….………

54- 0.12 m3 of an ideal gas is exposed to reversible polytropic expansion from 300 kPa and 120°C to 100 kPa. 5 kJ of heat are transferred to the gas at constant pressure. The index of expansion (n) between original and final states is…………….. (Assume γ=1.4 and Cp = 1.0035 kJ/kg.K)

55- In gas cycle, the temperature and pressure related as $\frac{T_2}{T_1} = \left(\frac{P_2}{P_1}\right)^{\frac{k-1}{k}}$ for ………….process

56- Consider a medium in which the heat conduction equation is given in its simplest form as

$$\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial T}{\partial r}\right) = 0$$

$(a) -$ Cylindrical coordinates one-dimensional unsteady

$(b) -$ Spherical coordinates one-dimensional unsteady

$(c) -$ Both of them

$(d) -$ None of above

57- For one-dimension unsteady conduction equation has the following boundary condition. T(0,0)=0 , T(L,0)=0 and T(L/2,0)=100

$(a) -$ $100e^{-(\frac{\pi n}{L})^2}\alpha t\cos(\frac{n\pi}{L}x)$

$(b) -$ $100e^{-(\frac{\pi n}{L})^2}\alpha t\sin(\frac{n\pi}{L}x)$

$(c) -$ $100e^{-(\frac{\pi n}{L})^2}\alpha t\tan(\frac{n\pi}{L}x)$

$(d) -$ $100e^{-(\frac{\pi n}{L})^2}\alpha x\sin(\frac{n\pi}{x}L)$

58- What happens when the thickness of insulation on a pipe exceeds the critical value?

$(a) -$ Heat transfer rate increases
$(b) -$ Heat transfer rate decreases
$(c) -$ Heat transfer rate remain constant
$(d) -$ None of the above

59- The product of Reynolds number and Prandtl number is known as

$(a) -$ Stanton number
$(b) -$ Nusselt number
$(c) -$ Biot number
$(d) -$ Peclet number

60- The inner and outer surfaces of a 7-m by 4-m brick wall at temperatures of 20°C and 5°C, respectively. The wall thickness 30 cm and its thermal conductivity 0.69 W/m K. The rate of heat transfers through the wall equal to

$(a) -$ 0.966 kW
$(b) -$ 0.156 kW
$(c) -$ 0.698 kW
$(d) -$ 1.690 kW

61- For a plane wall let the thermal conductivity vary with distance x as $k = k_o(1+\alpha x)$, so that the rate of heat transfer will be

$(a) -$ $q = \frac{k_o A\propto(T_1-T_2)}{lin(1+\propto L)}$

$(b) -$ $q = \frac{k_o A(T_1-T_2)}{lin(1+\propto L)}$

$(c) -$ $q = \frac{k_o A(T_1-T_2)}{lin(1+k_o L)}$

$(d) -$ $q = \frac{A\propto(T_1-T_2)}{lin(1+k_o L)}$

62- Consider a 1.2-m-high and 2-m-wide glass window whose thickness is 6 mm and thermal conductivity is k = 0.78 W/m °C. The indoor is maintained at 24 °C while the temperature of the outdoors is –5° C. Take the convection heat transfer coefficients on the inner and outer surfaces of the window to be h1 = 10 W/m^2 °C and h2 = 25 W/m^2 °C, and disregard any heat transfer by radiation. The steady rate of heat transfers through this glass window are

$(a)-$ 214 kW

$(b)-$ 144 kW

$(c)-$ 714 kW

$(d)-$ 471 kW

63- A Cylinder of radius R made of a material having thermal conductivity k is surrounded by a cube having inner hole of radius R and outer dimension of 3 R each. Thermal conductivity of cube is 2K

$(a)-$ Zero

$(b)-$ k (2+π/9)

$(c)-$ k (2- π/9)

$(d)-$ None of the above

64- Consider a 0.8-m-high and 1.5 m wide double-pane window consisting of two 4mm thick layers of glass (k =0.78 W/m · °C) separated by a 10-mm-wide stagnant air space (k = 0.026 W/m · °C). Determine the steady rate of heat transfer through this double-pane window and the temperature of its inner surface for a day during which the room is maintained at 20°C while the temperature of the outdoors is 10°C. Take the convection heat transfer coefficients on the inner and outer surfaces of the window to be h_1 = 10 W/m^2 °C and h_2 = 40 W/m^2 · °C, which includes the effects of radiation.

65- A hot fluid is being conveyed through a long pipe of 4 cm outer diameter and covered with 2 cm thick insulation. It is proposed to reduce the conduction heat loss to the surroundings to one-third of the present rate by further covering with same insulation. Calculate the additional thickness of insulation.