الإسم الرباعي:

الرقم السري:

جامعة تكريت

كلية الهندسة

قسم الهندسة الميكانيكية

الوقت: ثلاث ساعات

الرقم السري: .....

الامتحان التنافسي للتقديم للدراسات العليا

للعام الدراسي 2023/2022

(الدكتوراه)

يوم الأثنين المصادف

2022/5/16

ملاحظات:

1- ضع دائرة حول الاجابة الصحيحة للأسئلة الاختيارية.

2- جميع الاسئلة لها نفس الدرجة.

3- عدد الأسئلة 35 سؤالا.

لجنة الدراسات العليا

قسم الهندسة الميكانيكية

وزارة التعليم العالي و البحث العلمي

جامعة تكريت

كلية الهندسة

القسم: الميكانيك

الدراسة: الدكتوراه

التاريخ:

الامتحان التنافسي للتقديم للدراسات العليا للعام الدراسي 2022-2023

رقم السؤال	الاجابة								الدرجة
1	A	○	B	○	C	○	D	○	
2	A	○	B	○	C	○	D	○	
3	A	○	B	○	C	○	D	○	
4	A	○	B	○	C	○	D	○	
5	A	○	B	○	C	○	D	○	
6	A	○	B	○	C	○	D	○	
7	A	○	B	○	C	○	D	○	
8	A	○	B	○	C	○	D	○	
9	A	○	B	○	C	○	D	○	
10	A	○	B	○	C	○	D	○	
11	A	○	B	○	C	○	D	○	
12	A	○	B	○	C	○	D	○	
13	A	○	B	○	C	○	D	○	
14	A	○	B	○	C	○	D	○	
15	A	○	B	○	C	○	D	○	
16	A	○	B	○	C	○	D	○	
17	A	○	B	○	C	○	D	○	
18	A	○	B	○	C	○	D	○	

رقم السؤال	الاجابة								الدرجة
19	A	○	B	○	C	○	D	○	
20	A	○	B	○	C	○	D	○	
21	A	○	B	○	C	○	D	○	
22	A	○	B	○	C	○	D	○	
23	A	○	B	○	C	○	D	○	
24	A	○	B	○	C	○	D	○	
25	A	○	B	○	C	○	D	○	
26	A	○	B	○	C	○	D	○	
27	A	○	B	○	C	○	D	○	
28	A	○	B	○	C	○	D	○	
29	A	○	B	○	C	○	D	○	
30	A	○	B	○	C	○	D	○	
31	A	○	B	○	C	○	D	○	
32	A	○	B	○	C	○	D	○	
33	A	○	B	○	C	○	D	○	
34	A	○	B	○	C	○	D	○	
35	A	○	B	○	C	○	D	○	
36	A	○	B	○	C	○	D	○	

وزارة التعليم العالي و البحث العلمي

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1- If $t = z^3$ transform $\int_0^\infty \sqrt{z} e^{-z^3} dz$ from z domain to t domain

2- If $v = f(u)$ where $u = y - 3x$ show that $f(u)$ is a general solution of

$$\frac{\partial v}{\partial x} = -3\frac{\partial v}{\partial y}$$

3- The differential equation $(1 - x^2)y'' - 2xy' + n(n+1)y = 0$ is

$(a)-$ Hermit Equation

$(b)-$ Euler – Cauchy Equation

$(c)-$ Bessel's equation

$(d)-$ Legendre's Equation

4- If $f(x)$ expanded by series in terms of **orthonormal** function $\phi(x)$ $0 \le x \le l$ as follow

$$f(x) = C_1\phi_1(x) + C_2\phi_2(x) + \cdots + C_n\phi_n(x) + \cdots \quad \text{then} \quad C_n \quad \text{is}$$

$(a)-$ $C_n = \int_0^l \phi_n(x)\, f(x)dx \Big/ \int_0^l \phi_n(x)\, dx$

$(b)-$ $C_n = \int_0^l \phi_n(x)\, dx \Big/ \int_0^l \phi_n(x) f(x)\, dx$

$(c)-$ $C_n = \int_0^l \phi_n(x)\, f(x)dx$

$(d)-$ $C_n = \int_0^l f(x)\, dx$

5- If $J_v(x)$ is first kind Bessel's function then, $J_{1/2}(x)$

$(a)-$ $\sqrt{\frac{2}{\pi x}}\cos x$

$(b)-$ $\sqrt{\frac{2}{\pi x}}\sin x$

$(c)-$ $\sqrt{\frac{2}{\pi x}}\tan x$

$(d)-$ $\sqrt{\frac{2}{\pi x}}\cot x$

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

$$\underbrace{\begin{bmatrix} m_1 & 0 \\ 0 & m_2 \end{bmatrix}}_{\boldsymbol{M}} \begin{Bmatrix} \ddot{x}_1 \\ \ddot{x}_2 \end{Bmatrix} + \underbrace{\begin{bmatrix} k_1 & k_1 \\ k_1 & k_1+k_2 \end{bmatrix}}_{\boldsymbol{K}} \begin{Bmatrix} x_1 \\ x_2 \end{Bmatrix} = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$$

in which $m_1 = \frac{1}{2}m_2$ and $k_1 = \frac{1}{2}k_2$, then, the natural frequencies of the system are

$(a)-$ $\omega_1^2 = \frac{1}{2}\frac{k_1}{m_1}$, $\omega_2^2 = 2\frac{k_1}{m_1}$

$(b)-$ $\omega_1^2 = \frac{1}{3}\frac{k_1}{m_1}$, $\omega_2^2 = 3\frac{k_1}{m_1}$

$(c)-$ $\omega_1^2 = \frac{3}{2}\frac{k_1}{m_1}$, $\omega_2^2 = \frac{2}{3}\frac{k_1}{m_1}$

$(d)-$ $\omega_1^2 = \frac{1}{4}\frac{k_1}{m_1}$, $\omega_2^2 = 4\frac{k_1}{m_1}$

7- If the stiffness and mass matrices of a system are $[k]$ and $[m]$ respectively, then the flexibility matrix $[a]$ of the system is

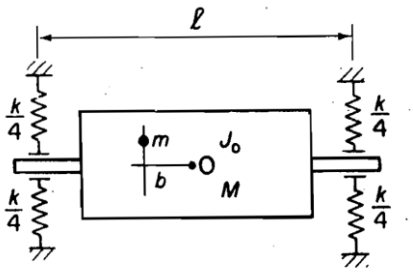
$(a)-$ $[k]^2$

$(b)-$ $[m]^{-1}$

$(c)-$ $[k]^{-1}$

$(d)-$ $[m]^{-1}[k]$

8- A rotor is mounted in bearings that are free to move in a single plane, as shown in Figure. The rotor is symmetrical about o with total mass M and moment of inertia J_0 about an axis perpendicular to the shaft. If a small unbalance mr acts at an axial distance b from its center o. Then this system is



$(a)-$ Free single degree of freedom

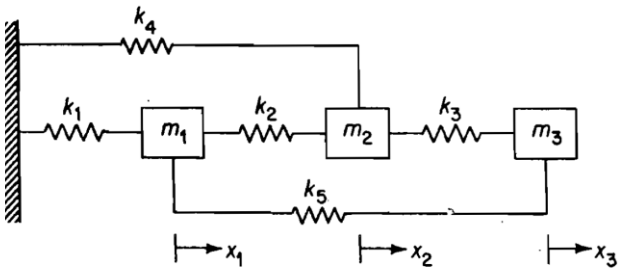
$(b)-$ Forced single degree of freedom

$(c)-$ Free two degree of freedom

$(d)-$ Forced two degree of freedom

9- If $\phi_1(x) = \frac{x}{L}$ and $\phi_2(x) = \left(\frac{x}{L}\right)^2$ are two admissible functions of a rod of length L and $m(x)$ is mass per unit length. Find m_{22} using Rayleigh-Ritz method.

10- Use stiffness influence coefficient find k_{13}



11- Plane stress condition in elasticity means

$(a)-$ $\sigma_z = 0$, $\varepsilon_z = 0$

$(b)-$ $\sigma_z \neq 0$, $\varepsilon_z = 0$

$(c)-$ $\sigma_z = 0$, $\varepsilon_z \neq 0$

$(d)-$ No one above

12- Principal plane in three dimensional stress system is a plane at which

$(a)-$ The normal stress is maximum and shear stress is zero

$(b)-$ The normal stress is zero and shear stress is maximum.

$(c)-$ The normal stress is equal to shear stress

$(d)-$ No one above

13- The octahedral normal stress in three dimensional stress system is

$(a)-$ $\sigma_{oct} = \frac{1}{3}(\sigma_1 + \sigma_3)$

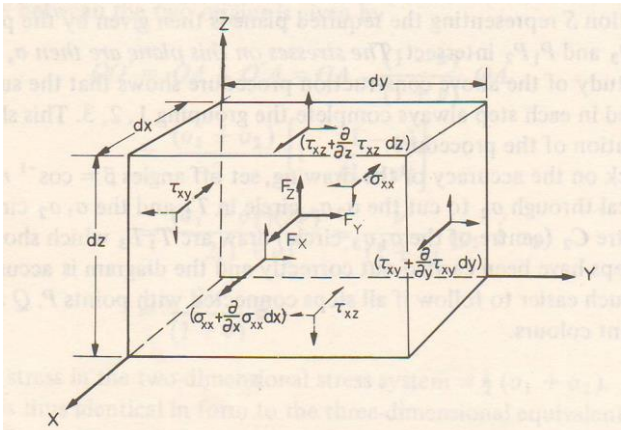
$(b)-$ $\sigma_{oct} = \frac{2}{3}\sqrt{\sigma_1^2 + \sigma_2^2 + \sigma_3^2}$

$(c)-$ $\sigma_{oct} = \frac{1}{3}(\sigma_1 + \sigma_2 + \sigma_3)$

$(d)-$ $\sigma_{oct} = \frac{2}{3}(\sigma_1^2 + \sigma_2^2 + \sigma_3^2)$

where σ_1, σ_2 and σ_3 are principal stresses

14- Figure shows the direct stresses σ_x, σ_y, σ_z and all shear stresses on an element of dimensions dx, dy, dz . F_x, F_y, F_z are body forces stress components. Determine the stress equation of equilibrium in X direction.



15- At a point in a material subjected to a three-dimensional stress system in the Cartesian stress coordinates are

$$\sigma_x = 100\ \text{MN}//m^2\ , \quad \sigma_y = 80\ \text{MN}//m^2, \quad \sigma_z = 150\ \text{MN}//m^2$$

$$\tau_{xy} = 40\ \text{MN}//m^2\ , \quad \tau_{yz} = -30\ \text{MN}//m^2, \quad \tau_{zx} = 50\ \text{MN}//m^2$$

Determine the component of the resultant stress in the X direction S_x on a plane whose normal has direction cosine $l = 52°, m = 68°$.

16- Draw a cooling curve of pure metal during casting

17- Describe very briefly the expanded polystyrene casting process

18- Highest temperature is achieved with …….. welding Process

$(a)-$ TIG

$(b)-$ MIG

$(c)-$ Plasma

$(d)-$ Electroslag welding

19- …… is thermal machining process

$(a)-$ Electric discharge machining

$(b)-$ Electrochemical machining

$(c)-$ Ultrasonic machining

$(d)-$ Abrasive jet machining

20- In metal forming processes …… remains constant

$(a)-$ The mass

$(b)-$ The volume

$(c)-$ Both mass and volume

$(d)-$ The pressure

21- 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

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

$(a)-$ Stanton number

$(b)-$ Nusselt number

$(c)-$ Biot number

$(d)-$ Peclet number

23- Heat is mainly transferred by conduction, convection and radiation in

$(a)-$ Insulated pipes carrying hot water

$(b)-$ Refrigerator freezer coil

$(c)-$ Boiler furnaces

$(d)-$ Condensation of steam in a condenser

24- 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.

25- **a**) A hollow sphere is constructed of aluminum (k =204 W/m • °C) with an inner diameter of 4 cm and an outer diameter of 8 cm. The inside temperature is 100°C and the outer temperature is 50°C. Calculate the heat transfer.

b) if the sphere is covered with a 1-cm layer of an insulating material having k =50 W/m. ◦C and the outside of the insulation is exposed to an environment with h=20 W/m^2 .°C and Temperature =10°C. The inside of the sphere remains at 100°C. Calculate the heat transfer under these conditions.

26- A material in which the ordered regions contain only a few atoms is termed

$(a)-$ amorphous
$(b)-$ glassy
$(c)-$ polycrystalline
$(d)-$ single crystalline

27- Diffusion is normally an activated process in

$(a)-$ solid
$(b)-$ liquid
$(c)-$ gasses
$(d)-$ liquid and gasses

28- The fatigue resistance of a material is reduced by

$(a)-$ permanent residual compressive stress
$(b)-$ a mean positive (tensile test)
$(c)-$ chemically or mechanically hardening of the surface
$(d)-$ poor surface finish

29- A plain carbon steel of 0.6 C% has fatigue limit of 320 Mpa when mean stress is zero and tensile strength of 740 MPa. Calculate the fatigue limit at mean stress of 200 MPa

30- Determine the diffusion coefficient of Ni atoms in F.C.C. iron at 500 c° if D_O 7.7 x 10^{-5} m^2 /s , E_a 280 kj/ m , k 1.38 x10^{-23} j/k ,Avogadro number of 6.02 x 10^{23} atom/ mol

31- Entropy is ..... proportional to the reversibility.

$(a)-$ Indirectly

$(b)-$ Directly

$(c)-$ Directly or indirectly

$(d)-$ None of the above

32- For constant pressure process, boundaries are.....

$(a)-$ Finite

$(b)-$ Fixed

$(c)-$ Movable

$(d)-$ Infinite

33- What is the effect on quality of the energy when it is conserved?

$(a)-$ The quality of the energy increases while conserving its quantity

$(b)-$ The quality of the energy decreases while conserving its quantity

$(c)-$ The quality of the energy remains same while conserving its quantity

$(d)-$ None of the above

34- For a certain reaction, Δu=2.1 kcal, Δpv=200 cal, Δs=20 cal at 300 K, Gibbs function (G) = ……

35- The second law efficiency, η_{2nd} = …….