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Tikrit University/ College of Engineering/ Mechanical Eng. Dept.
Competitive Exam for Post-Graduate Candidates/ MSc (2024-2025)

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Q1: The partial derivative of the function $f(x; y; z) = e^{1-x\cos y} + z\,e^y$ with respect to x at the point $(1; 0; \pi)$.

A. -1	B. $\frac{-1}{e}$
C. π	D. 0

Q2: The value of $\frac{\partial z}{\partial y} = 8x^3 + 6xy^2 + 4$. What is the function z expressed as?

A. $z = 8x^3 + 2x^2\,y^2 + 4x$

B. $z = 8x^2 y + 2x\,y^3 + 4y$

C. $z = 8y + 2xy^2 + 4y$

D. $z = 16x + 6y^2$

Q3: While solving a partial differential equation using a variable separable method, we equate the ratio to a constant which?

A. can be positive or negative integer or zero

B. must be a negative integer

C. must be a positive integer

D. can be positive or negative rational number or zero

Q4: The scalar product of $5i + j - 3k$ and $3i - 4j + 7k$ is

A. 15

B. -15

C. 10

D. -10

Q5: The inverse Laplace transform of $\frac{4}{s(s^2-16)}$ is

A. $\int_0^t \sinh 4x\, dx$

B. $\int_0^t \cosh 4x\, dx$

C. $\sinh 4t$

D. $\cosh 4x$

Q6: Consider the following partial differential equation $z_{xx} + B\,z_{xy} - z_{yy} = 0$. For this equation to be classified as hyperbolic, the value of B must be

A. 3

B. 2

C. 0

D. 1

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Q7: Which of the following is related to Cauchy-Riemann equations?

A. $u_x = u_y$ and $v_x = v_y$ B. $u_x = v_y$ and $u_y = v_x$

C. $u_x = u_y$ and $v_x = u_y$ D. $u_x = v_y$ and $u_y = -v_x$

Q8: The solution of the differential equation $2y'' - 5y' - 3y = 0$ is:

A . $y = c_1 x e^{6x} - c_2 e^{6x}$ B. $y = c_1 e^{-x/2} + c_2 e^{3x}$

C. $y = c_1 e^{2x} - c_2 e^{-3x}$ D. $y = c_1 e^{-2x} + c_2 e^{x/3}$

Q9: Cross product of two vectors can be used to find?

A. area of rectangle   B. area of parallelogram square

C. area of square   D. perimeter of rectangle

Q10: The natural frequency of the system shown in Figure (1) is

where I_c:-moment of inertia about center
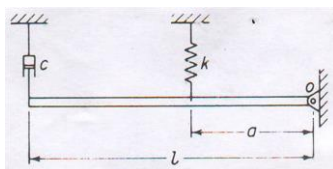
where I_o:-moment of inertia about o

Figure (1)

A. $\sqrt{\dfrac{ka^2}{I_c}}$ B. $\sqrt{\dfrac{ka^2}{I_o}}$

C. $\sqrt{\dfrac{kl^2}{I_c}}$ D. $\sqrt{\dfrac{kl^2}{I_o}}$

Q11: If = $4.534\ kg$, $k = 3500\ N/m$, $c = 12.43\ N.s/m$ then the logarithmic decrement of the system is

A. 0.52   B. 0.45

C. 0.31   D. 0.62

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Q12: The best value of damping factor ζ of the pointer of ammeter is

A. 1   B. 1.1

C. 0.9   D. 0.707

Q13: A system consists of a mass $m = 10$ kg, and spring with stiffness $k = 8000 \, N/m$, then the period of one oscillation τ is

A. 0.422 sec.   B. 0.322 sec.

C. 0.222 sec.   D. 0.522 sec.

Q14: The phase angle ϕ between the response and excitation at resonance in single degree of freedom system is

A. $180°$ B. $-180°$

C. $90°$ D. $360°$

Q15: Two parallel plates, one moving at 4 m/s and the other stationary, are separated by 5 mm thick layer of oil with specific gravity (δ =0.8) and kinematic viscosity ($\upsilon = 1.25 \times 10^{-4}$ m^2/s). **What is the average shear stress in the oil?** Take the densities of water 1000 kg/m^3.

A.   80 Pa   B.   100 Pa

C.   125 Pa   D.   160 Pa

Q16: Determined the location of the pressure center over the surface that immersed in a liquid.

A.   always above the centroid   B.   will be at the centroid

C.   will be below the centroid   D.   All are true

Q17: Bulk modulus is the ratio of what

A.   Shear stress to volumetric strain   B.   volumetric strain to shear stress

C.   compressive stress to volumetric strain   D.   volumetric strain to compressive stress

Q18: An open tank contains 1 m deep water with 50 cm depth of oil of specific gravity 0.8 above it (g=9.81 m/s^2). The intensity of pressure at the bottom of tank will be

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A. 4 kN/m^2 B. 10 kN/m^2

C. 12 kN/m^2 D. 14 kN/m^2

Q19: In the Turbulent flow of entrance region length to the diameter of pipe is equal to:

A. $0.6 \, Re_D^2$ B. $0.08 \, Re_D^{1/2}$

C. $4.4 \, Re_D^{1/3}$ D. $4.4 \, Re_D^{1/6}$

Q20: Mercury does not wet glass. This is due to property of liquid known as

A. Adhesion   B.   cohesion

C. surface tension   D.   viscosity

Q21: Which of the following is correct regarding two-dimensional conduction heat transfer?

A. Steady - $f(x,y,t)$, Unsteady- $f(x,y,t)$ B. Steady- $f(x,y,t)$, Unsteady- $f(x,y)$

C.   Steady - $f(x,y)$, Unsteady - $f(x,y,t)$ D.   Steady - $f(x)$, Unsteady- $f(x,t)$

Q22: In heat dissipation from a fin of finite length, the boundary conditions are

$P = 2w + 2t$
$A_c = wt$
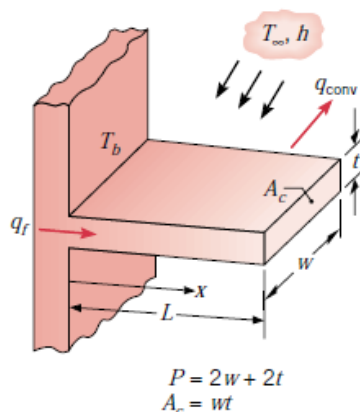
A. $T(x) = T_L$ at $x = L$ and $T(x) = T_b$ at $x = 0$ B. $T(x) = T_L$ at $x = 0$ and $T(x) = T_b$ at $x = L$

C. $T(x) = T_b$ at $x = L$ and $T(x) = T_\infty$ at $x = 0$ D. $T(x) = T_b$ at $x = L$ and $T(x) = T_\infty$ at $x = \infty$

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Q23: The critical Renolds number for the force convection in external flow over flat plate is

A. 5×10^{10} *B.* 6×10^6

C. 2300   D. 5×10^5

Q24: The surface temperatures of a plate with thickness of 0.06 m are 100°C and 40°C. The thermal conductivity *(k)* of wall is 350 W/mK. What is the rate of heat transfer through the plate in kW/m²?

A. 350000   B. 350

C. 35   D. 0.35

Q25: Heat exchanger with a hot fluid inlet temperature of 75 °C and cold fluid inlet temperature is 25 °C. Through the heat exchanger, the temperature difference of the minimum fluid is 30°C. calculate the heat exchanger effectiveness.

A. 50%   B. 60%

C. 70%   D. 80%

Q26: A definite area or space where some thermodynamic process takes place is known as

A. Thermodynamic system   B. Thermodynamic cycle

C. Thermodynamic process   D. Thermodynamic law

Q27: The main cause of the irreversibility is:

A. Mechanical and fluid friction   B. Unrestricted expansion

C. Heat transfer with a finite temperature difference   D. All of the above

Q28: With the increase in pressure

A. Boiling point of water increases and enthalpy of evaporation increase   B. Boiling point of water increases and enthalpy of evaporation decreases

C. Boiling point of water decreases and enthalpy of evaporation increases   D. Boiling point decreases and enthalpy of evaporation decreases

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Q29: Second law of thermodynamic defines

A. heat

B. work

C. enthalpy

D. entropy

Q30: 0.3 kg of gas at 100kPa and 40℃ is contained in a cylinder. The piston is moved compressing the gas until the pressure becomes 1000kP and temperature becomes 160℃. The work done during the process is 30 kJ. Calculate the heat transfer Q from the gas to the surroundings. Take c_v=0.75 kJ/kg K

A. 57KJ

B. -3KJ

C. 7KJ

D. 10KJ

Q31: Acyclic heat engine operates between a source temperature of 1273K and a sink of 313K . Find the least rate of heat rejection per 1kW net output of the engine.

A. 1.326 kW

B. 0.326 kW

C. 1.7 kW

C. 2.5 kW

Q32: Which among the following is a metal?

A. Chlorine

B. Hydrogen

C. Sodium

D. Sulphu

Q33: Which among the following is the strongest metal?

A. Chlorine

B.   Hydrogen

C. Tungsten

D. Calcium

Q34: A roll diameter of 300 mm has a maximum possible reduction of 3 mm, find the angle of bite for the process?

A. 10.25

B. 5.71

C. 18.32

D. 89.25

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Q35: Tensile testing of metals is done using...........

A. Universal Testing Machine   B. Durometer

C. Tribometer   D. Uniaxial Testing Machine

Q36: Which of the following is a method of applying a protective zinc coating to steel?

A. Galvanizing   B. Glazing

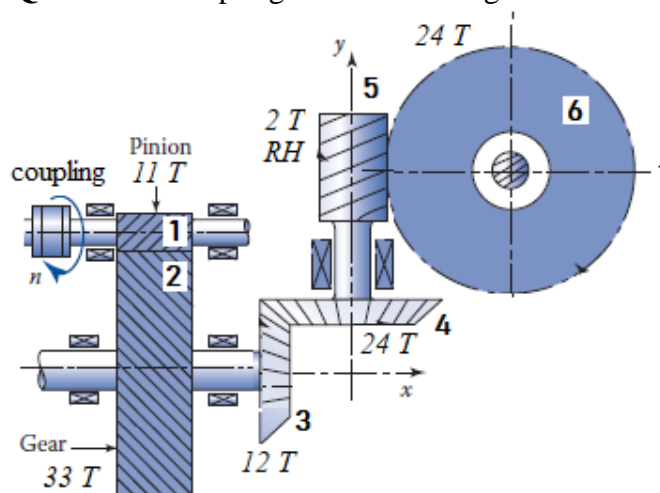C. Hydroforming   D. Metal punching

Q37: A pipe has a length 0.40 m and it supports a compressive load of 40 kN. The pipe shortens by 0.5 mm when the load is applied. The compressive strain in the pipe when supporting this load is ……………..m/m

A. 0.00025   B. 0.00125
C. 0.00225   D. 0.00325

Q38: A circular hole of diameter 50 mm is to be punched out of a 2 mm thick metal plate. The shear stress needed to cause fracture is 500 MPa. The minimum force to be applied to the punch is…………..kN

A. 157.1   B. 167.1
C. 147.1   D. 137.1

Q39: If the coupling shown in the figure rotates 72 revolutions, gear 6, will rotates

A. one revolution, clockwise   B. one revolution, anticlockwise

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C. ten revolutions, clockwise   D. ten revolutions, anticlockwise

**Q40:** Spring index is
    A. its capability of storing energy   B. the load required to produce unit deflection
   C. the ratio of coil diameter to wire diameter   D. indication of quality of spring

Q41 : When designing a pressed connections, the possibility of its disassembly must be considered. Parts to be pressed out must have surfaces (preferably flat) which can rest during the pressing out upon solid plates or bushes. A poor design is illustrated in figure………..?

(A)   (B)   (C)
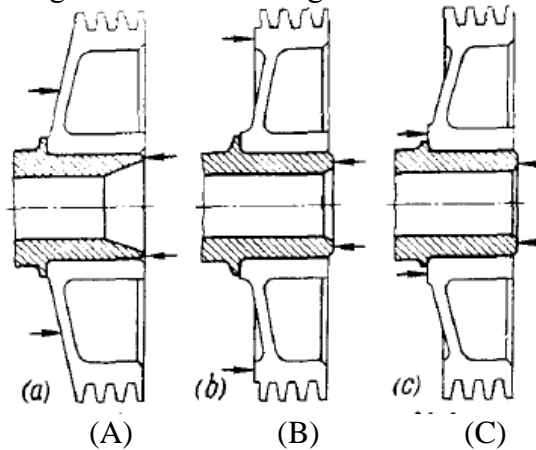
Q42: The sizes of the vaulted recesses in height and cross-section must permit easy assembly of fastening parts. With insufficient height (i.e., when the Fig. Mounting fasteners in recesses clearance h between the recess ceiling and stud end face is less than nut height ho, the unit can be assembled only by raising the part and placing all the nuts on the studs ends as in …… ….?

(a)   (b)   (c)
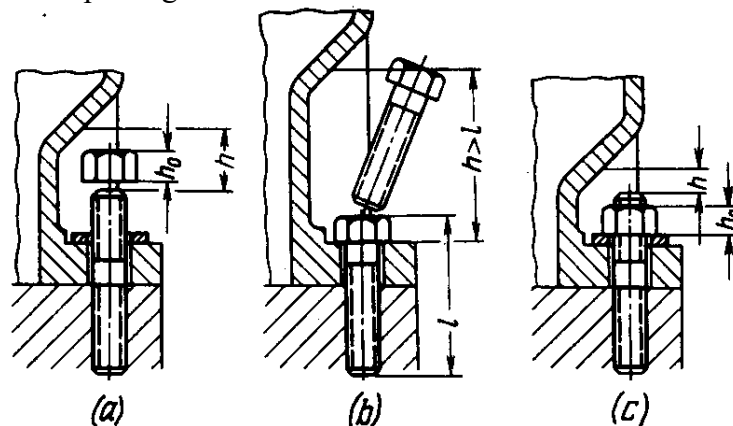
Q43: Belt slip may occur due to
    A. heavy load   B. loose belt
    C. driving pulley too small   D. all of the above

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Q44: When assembling parts having two seating surfaces, the parts should be fitted into their seats locating in a proper sequence. The correct design sequence is illustrated in Fig..........?

(a)   (b)   (c)
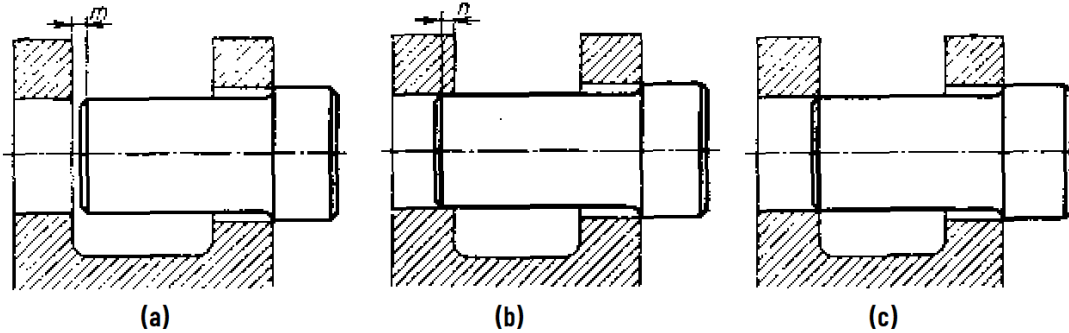
Q45: في عملية الدرفلة يتم سحب المعدن بين الدرفيلين بوساطة:

A. قوى الضغط   B. قوى السحب

C. قوى الدفع   D. قوى الاحتكاك

Q46: طريقة البثق المستخدمة في انتاج الاشكال الانبوبية القصيرة مثل انتاج علب معاجين الاسنان وغيرها تسمى :

A. البثق المباشر   B. البثق الهايدروستاتيكي

C. البثق الخلفي   D. البثق الصدمي

Q47: قابلية الرمل على عدم الالتصاق الى سطح المسبوكة بعد التجمد والتبريد تسمى :

A. الانسيابية   B. الانفاذية

C. التهشمية   D. الالتصاقية

Q48: عند القطع بسرعة 250 م/ دقيقة كان عمر اداة القطع 9 دقائق. ماهي سرعة القطع التي تعطي عمر للاداة مقداره 160 دقيقة اذا علمت ان قيمة الاس 0.22

A. 180.5 م/دقيقة   B. 132.73 م/دقيقة

C. 145.86 م/دقيقة   D. 110.06 م/دقيقة

Q49: يسبب احتباس الغاز داخل معدن اللحام وانعزاله بصورة فقاعات صغيرة:

A. المتضمنات   B. المسامية

C. التشققات   D. التغلغل غير المكتمل

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Q50: قابلية المادة على امتصاص الطاقة لحفظ العدة من التشظي تسمى

A. مقاومة البلى	**B.** الصلادة
C. الجساءة	**D.** الخمولية

Good Luck

Examination Committee