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UPPSC-2019

UTTAR PRADESH PUBLIC
SERVICE COMMISSION 2019

Assistant Engineer

Mechanical Engineering
PAPER-I

Exam held on 13-12-2020

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Questions and Answer Keys

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Q.1 इनमें से दन्त्य ध्वनियाँ हैं

- (a) च, छ, ज, झ (b) प, फ, ब, भ
(c) त, थ, द, ध (d) ट, ठ, ड, ढ

Ans. (c)

Q.2 इनमें से व्यंजन सन्धि आधारित शब्द है

- (a) अन्वेषण (b) उद्धार
(c) लघूर्मि (d) पुरोहित

Ans. (b)

Q.3 "चौराहा" शब्द में समास है

- (a) तत्पुरुष (b) बहुव्रीहि
(c) अव्ययीभाव (d) द्विगु

Ans. (d)

Q.4 'निवृत्ति' शब्द का विलोम है

- (a) सद्वृत्ति (b) सुवृत्ति
(c) प्रवृत्ति (d) कुवृत्ति

Ans. (b)

Q.5 निम्नलिखित में से 'शारदा' का पर्यायवाची शब्द है

- (a) कमला (b) कौमुदी
(c) वारुणी (d) गिरा

Ans. (d)

Q.6 निम्नलिखित में से तद्भव शब्द है

- (a) वानर (b) तेल
(c) पीत (d) घोटक

Ans. (b)

Q.7 'मृत्यु के इच्छुक' – इस वाक्यांश के लिए एक शब्द है

- (a) मुमुक्षा (b) मुमूर्षु
(c) मुमूर्षा (d) मुमुक्षु

Ans. (b)

Q.8 'चीनांशुक' शब्द का अर्थ है

- (a) तंतु (b) रेणु
(c) रेशम (d) चीनी मिट्टी

Ans. (d)

Q.9 'अंदर-अंदर कड़ाही में गुड़ पगना' – इस मुहावरे का सही अर्थ है

- (a) ज्ञान होना (b) गुप्त मंत्रणा होना
(c) स्वसीमित होना (d) किसी काम न आना

Ans. (b)

Q.10 अनेकार्थक शब्द 'सारंग' का निम्नलिखित में से एक अर्थ नहीं है

- (a) भौरा (b) कामदेव
(c) तलवार (d) ज्योतिषी

Ans. (c)

Q.11 निम्नलिखित में से शुद्ध वर्तनी का शब्द है

- (a) अनाधिकार (b) रचइता
(c) सहस्त्र (d) संग्रहीत

Ans. (c)

Q.12 समास-योजना की दृष्टि से इनमें से एक अशुद्ध युग्म है

- (a) सतसई – द्विगु समास
(b) तुलसीकृत – तत्पुरुष समास
(c) मंदोदरी – बहुव्रीहि समास
(d) मरणासन्न – अव्ययीभाव समास

Ans. (c)

Q.13 अलग होने के अर्थ में 'से' कारक-चिह्न का प्रयोग होता है

- (a) अपादान कारक में
 (b) करण कारक में
 (c) करण कारक तथा अपादान कारक दोनों में
 (d) सम्बन्ध कारक में

Ans. (c)

Q.14 'पवन' शब्द का सन्धि-विच्छेद है

- (a) पौ + अन (b) पो + अन
 (c) प + अवन (d) प + वन

Ans. (b)

Q.15 इनमें से शुद्ध वर्तनी का रूप है

- (a) निरझरणी (b) निरझरिणी
 (c) निर्झरिणी (d) निर्झरणी

Ans. (c)

Q.16 निम्नलिखित में से एक शब्द में उपसर्ग का प्रयोग नहीं हुआ है, वह शब्द है :

- (a) सहज (b) अनुभव
 (c) संचार (d) नयन

Ans. (d)

Q.17 इनमें से 'अनघ' का विलोम शब्द है

- (a) निरघ (b) अघी
 (c) कृती (d) सनघ

Ans. (d)

Q.18 इनमें से 'पक्षी' शब्द का पर्यायवाची नहीं है

- (a) पिशुन (b) विहंग
 (c) शकुनि (d) द्विज

Ans. (a)

Q.19 नीचे दिये गये वाक्यांश और उसके लिए प्रयुक्त होने वाले एक शब्द का एक युग्म गलत है, वह है

- (a) उत्तराधिकार में प्राप्त सम्पत्ति – धरोहर
 (b) जिसे प्रमाण द्वारा सिद्ध न किया जा सके – अप्रमेय

(c) सीमा का अनुचित रूप से किया गया उल्लंघन – अतिक्रमण

(d) पूरब और उत्तर (दिशा) के बीच का कोना – ईशान

Ans. (a)

Q.20 निम्नलिखित में से 'महीसुर' शब्द का अर्थ है

- (a) पृथ्वी का रक्षक (b) महिषासुर
 (c) राक्षस (d) ब्राह्मण

Ans. (a)

Q.21 निम्नलिखित में से तत्सम शब्द है

- (a) विवाह (b) ईख
 (c) खीर (d) गिद्ध

Ans. (a)

Q.22 'ने + अन' = 'नयन' में सन्धि है

- (a) यण सन्धि (b) गुण सन्धि
 (c) अयादि सन्धि (d) वृद्धि सन्धि

Ans. (c)

Q.23 निम्नलिखित में से शुद्ध वर्तनी का शब्द है

- (a) उज्ज्वल (b) उज्जवल
 (c) उजवल (d) उज्वल

Ans. (a)

Q.24 'बुद्धिहीन' शब्द व्याकरण की दृष्टि से इनमें से किस संवर्ग में है?

- (a) संज्ञा (b) सर्वनाम
 (c) विशेषण (d) क्रिया

Ans. (c)

Q.25 इनमें से एक वाक्य शुद्ध है, वह है :

- (a) मेरा प्राण संकट में है।
 (b) सोमवार को रेलवे के कई कर्मचारी गिरफ्तार हुए।
 (c) अपराधी को मृत्युदंड की सजा दी गयी है।
 (d) महादेवी वर्मा छायावाद की प्रसिद्ध कवयित्री हैं।

Ans. (d)



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Q.26 Material handling and plant location is analysed by
 (a) Gantt Chart (b) Bin Chart
 (c) Travel Chart (d) Emerson Chart

Ans. (c)

Q.27 In PERT and CPM network the dummy activity
 (a) Consumes time
 (b) Consume resources
 (c) Is used to preserve the logic
 (d) Is a real activity

Ans. (c)

Q.28 The following measurement are carried out by internal state sensors of the end effector
 (a) Position
 (b) Position and Velocity
 (c) Velocity and Acceleration
 (d) Position, Velocity and Acceleration

Ans. (d)

Q.29 In a microprocessor, RISC stands for
 (a) Restructured Instruction Set Computer
 (b) Redefined Instruction Set Computer
 (c) Reduced Instruction Set Computer
 (d) Regional Instruction Set Computer

Ans. (c)

Q.30 Which of the following provides anticlockwise and clockwise rotation about the vertical axis perpendicular to the arm?
 (a) Shoulder swivel (b) Arm sweep
 (c) Wrist bend (d) Elbow extension

Ans. (b)

Q.31 PLC operates on following signals
 (a) Digital (b) Impulse
 (c) Analog (d) Frequency

Ans. (a)

Q.32 A disc of radius 30 cm is rolling without slip with angular velocity of 10 rad/s on a horizontal surface. Which of the following statements is NOT true?
 (a) Linear velocity of all the points is different
 (b) Speed of all the points is different

(c) Acceleration of all the points is different
 (d) Linear velocity of the point touching the horizontal surface is zero.

Ans. (b)

Q.33 The ratio of magnitude of linear momentum for two objects having mass 30 kg and 10 kg respectively with equal kinetic energy is

(a) $\sqrt{\frac{1}{3}}$ (b) $(3)^2$
 (c) $\sqrt{3}$ (d) $\left(\frac{1}{\sqrt{3}}\right)^2$

Ans. (c)

Q.34 Condition for stable equilibrium of a conservative force system in terms of potential energy U is

(a) $\delta U = 0$ and $\delta^2 U = 0$
 (b) $\delta U = 0$ and $\delta^2 U > 0$
 (c) $\delta U = 0$ and $\delta^2 U < 0$
 (d) $\delta U > 0$ and $\delta^2 U = 0$

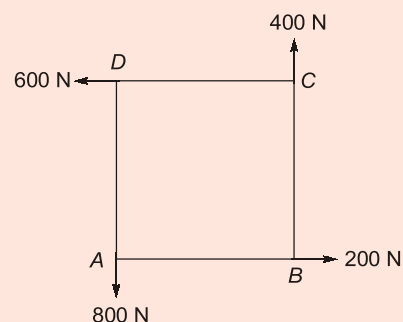
Ans. (b)

Q.35 A simply supported beam of length l , carries a load $w(x) = w_0(x)$ over the entire span. Maximum bending moment in the beam at x will be

(a) $\frac{l}{3}$ (b) $\frac{l}{\sqrt{3}}$
 (c) $\frac{l\sqrt{3}}{2}$ (d) $\frac{l}{\sqrt{2}}$

Ans. (b)

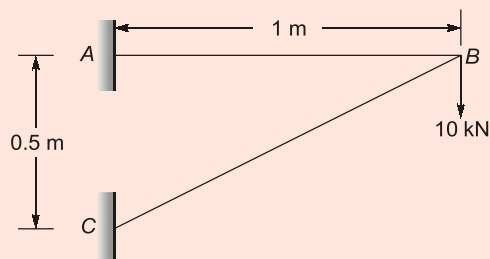
Q.36 Four forces having magnitudes of 200 N, 400 N, 600 N and 800 N respectively acting along four sides (1 m each) of a square ABCD as shown in figure. Determine the magnitude of direction of the force from A along the line AB.



- (a) $400\sqrt{3}$ N, 3.2 m from A
 (b) $400\sqrt{2}$ N, 2.5 m from A
 (c) $300\sqrt{2}$ N, 2 m from A
 (d) $300\sqrt{3}$ N, 2.5 m from A

Ans. (b)

Q.37 A two member truss ABC is shown in figure. The axial force (in kN) transmitted in member AB is



- (a) 40 kN (b) 10 kN
 (c) 20 kN (d) 30 kN

Ans. (c)

Q.38 If the propeller of an aeroplane rotates clockwise when viewed from the rear and the aeroplane takes a right turn, the gyroscopic effect will

- (a) Tend to raise the tail and depress the nose
 (b) Tend to raise the nose and depress the tail
 (c) Tilt the aeroplane about spin axis
 (d) Have no effect

Ans. (a)

Q.39 A man is climbing up a ladder which is resting against a vertical wall. When he was exactly half way up, the ladder started slipping. The path traced by the man is

- (a) Parabola (b) Circle
 (c) Ellipse (d) Hyperbola

Ans. (b)

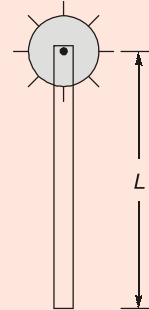
Q.40 When the primary direct crank of a reciprocating engine positioned at 30° clockwise, the secondary reverse crank for balancing will be at

- (a) 30° anticlockwise
 (b) 60° anticlockwise

- (c) 30° clockwise
 (d) 60° clockwise

Ans. (b)

Q.41 A thin uniform rod of length L and mass M is free to rotate in vertical plane as shown in figure below. The time period of its oscillation in vertical plane is



- (a) $T = 2\pi\sqrt{\frac{L}{2g}}$ (b) $T = 2\pi\sqrt{\frac{2L}{3g}}$
 (c) $T = 2\pi\sqrt{\frac{L}{g}}$ (d) $T = 2\pi\sqrt{\frac{3L}{4g}}$

Ans. (b)

Q.42 A 60 kg man is weighted by a balance as 54 kg in lift which is accelerated downwards. The acceleration of the lift is

- (a) 1.26 m/s^2 (b) 1.98 m/s^2
 (c) 0.98 m/s^2 (d) 1.76 m/s^2

Ans. (c)

Q.43 Smallest and largest natural frequency of a 'n' degree freedom system are ω_1 and ω_n respectively. Approximate natural frequency estimated by Rayleigh's and Dunkerley's methods are ω_r and ω_d respectively. Which of the following statements is true?

- (a) $\omega_r < \omega_1$ and $\omega_d < \omega_1$
 (b) $\omega_r < \omega_1$ and $\omega_d > \omega_1$
 (c) $\omega_r > \omega_1$ and $\omega_d > \omega_1$
 (d) $\omega_r > \omega_1$ and $\omega_d < \omega_1$

Ans. (d)

Q.44 A thin spherical shell is subjected to an external pressure p_0 . The volumetric strain of the spherical shell is (where, d is the diameter of shell, t is the

thickness of the shell, E is Young's modulus of elasticity of shell material, μ is Poisson's ratio of shell material)

- (a) $\frac{\rho_0 d}{4tE}(5-4\mu)$ (b) $\frac{3\rho_0 d}{4tE}(1-\mu)$
 (c) $\frac{3\rho_0 d}{4tE}(1-2\mu)$ (d) $\frac{-3\rho_0 d}{4tE}(1-\mu)$

Ans. (d)

Q.45 When there is a sudden increase or decrease in shear force diagram between any two points, it indicates that there is

- (a) No loading between the two points
 (b) Point load at the two points
 (c) Uniformly varying load between the two points
 (d) Uniformly distributed load between the two points

Ans. (b)

Q.46 Maximum shear stress in a solid shaft of diameter D and Length L twisted through an angle θ is τ . A hollow shaft of the same material and length having outside and inside diameters of D and $\frac{D}{2}$ respectively is also twisted through the same angle of twist θ . The value of maximum shear stress in the hollow shaft will be

- (a) $\frac{16}{15}\tau$ (b) $\frac{8}{7}\tau$
 (c) $\frac{4}{3}\tau$ (d) τ

Ans. (d)

Q.47 A spring used to absorb shocks and vibrations is

- (a) Torsion spring (b) Conical spring
 (c) Leaf spring (d) Disc spring

Ans. (c)

Q.48 Two shafts of equal length and similar material in which one is hollow and other is solid are transmitting same level of torque. If the inside diameter is $\frac{2}{3}$ of the outside diameter of the

hollow shaft, the ratio of weight of hollow shaft to weight of solid shaft is

- (a) 0.642 (b) 0.358
 (c) 0.732 (d) 1.444

Ans. (a)

Q.49 For the state of stress of pure shear τ , the strain energy stored per unit volume in the elastic, homogeneous, isotropic material having elastic constants-Young's modulus, E and Poisson's ratio ν will be

- (a) $\frac{\tau^2}{E}(1+\nu)$ (b) $\frac{\tau^2}{2E}(1+\nu)$
 (c) $\frac{2\tau^2}{E}(1+\nu)$ (d) $\frac{2\tau^2}{2E}(2+\nu)$

Ans. (a)

Q.50 A circular solid rod of diameter 'd' welded to a rigid flat plate by a circular fillet weld of throat thickness 't' is subjected to a twisting moment 'T'. The maximum shear stress induced in the weld is

- (a) $\frac{T}{\pi t d^2}$ (b) $\frac{2T}{\pi t d^2}$
 (c) $\frac{4T}{\pi t d^2}$ (d) $\frac{8T}{\pi t d^2}$

Ans. (b)

Q.51 The notch sensitivity q is expressed in terms of fatigue stress concentration factor K_f and theoretical stress concentration factor K_t as

- (a) $\frac{K_f + 1}{K_t + 1}$ (b) $\frac{K_f - 1}{K_t - 1}$
 (c) $\frac{K_t + 1}{K_f + 1}$ (d) $\frac{K_t - 1}{K_f - 1}$

Ans. (b)

Q.52 A shaft has dimension $\phi 35$ (-0.009 to -0.025). The respective values of fundamental deviation and tolerance are

- (a) -0.025 ± 0.008 (b) $-0.025, 0.016$
 (c) -0.009 ± 0.008 (d) $-0.009, 0.016$

Ans. (d)






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Q.53 A thin walled spherical shell is subjected to an internal pressure. If the radius of the shell is increased by 1% and the thickness is reduced by 1% with the internal pressure remaining the same, the % change in circumferential (hoop) stress is

- (a) 0 (b) 1
(c) 1.08 (d) 2.02

Ans. (d)

Q.54 If there are n_1 discs on the driving shaft and n_2 discs on the driven shaft in a multiplate clutch, then the number of pairs of contact surface is

- (a) $n_1 + n_2$ (b) $n_1 + n_2 - 1$
(c) $n_1 + n_2 + 1$ (d) $n_1 + n_2 + 2$

Ans. (b)

Q.55 When a helical compression spring is cut into halves, the stiffness of the resulting spring will be

- (a) One half (b) One fourth
(c) Double (d) Same

Ans. (c)

Q.56 Chromium as an alloying element in alloy steel is used principally to

- (a) Improve harden ability
(b) Improve mechanical properties at low temperature
(c) Improve mechanical properties at elevated temperature
(d) Improve the corrosion and oxidation resistance

Ans. (d)

Q.57 The compositions of some of the alloy steels are as under

1. 18W4Cr1V 2. 12M₀1W4Cr1V
3. 5M₀6W4Cr2V 4. 18W8Cr1V

The composition of commonly used high speed steels would include

- (a) 1 and 2 (b) 2 and 3
(c) 1 and 4 (d) 1 and 3

Ans. (d)

Q.58 The materials which show direction dependent properties are called

- (a) Homogeneous materials
(b) Viscoelastic materials
(c) Isotropic materials
(d) Anisotropic materials

Ans. (d)

Q.59 Atomic radius of Face Centered Cubic (FCC) crystal is

a = Lattice parameter

- (a) $\frac{a\sqrt{2}}{4}$ (b) $\frac{a\sqrt{3}}{2}$
(c) $\frac{a\sqrt{3}}{4}$ (d) $\frac{a\sqrt{2}}{3}$

Ans. (a)

Q.60 Which of the following phase of steel is NOT present in iron-carbon phase diagram?

- (a) Ferrite (b) Cementite
(c) Austenite (d) Martensite

Ans. (d)

Q.61 The machine tool guide ways are usually hardened by

- (a) Induction hardening
(b) Flame hardening
(c) Vacuum hardening
(d) Matempering

Ans. (b)

Q.62 Twin boundaries are which type of crystal defect?

- (a) Line defect (b) Point defect
(c) Surface defect (d) None of the above

Ans. (c)

Q.63 The function of interpolator in a CNC machine controller is to

- (a) Control spindle speed
(b) Control feed rate of axes
(c) Control tool rapid speed
(d) Perform miscellaneous (M) function

Ans. (b)

Q.64 During calculation of material removal rate in electro-discharge machining, supply voltage was used 60 V. Condition for maximum power delivery to the discharge circuit is satisfied. The ratio of actual to calculated material removal rate will be

- (a) $\frac{3}{2}$ (b) $\frac{4}{9}$
 (c) $\frac{9}{4}$ (d) $\frac{2}{3}$

Ans. (b)

Q.65 Straight polarity in arc welding is obtained with

(a) Alternating current electrode with electrode being positive
 (b) Direct current electrode with electrode being positive
 (c) Direct current electrode with electrode being negative
 (d) Alternating current electrode with electrode being negative

Ans. (c)

Q.66 A good machinability rating would indicate

(a) Long tool life, high power requirement and less machining time
 (b) Long tool life, low power requirement and a good surface finish
 (c) Short tool life and a good surface finish
 (d) Long tool life, high power requirement and a good surface finish

Ans. (b)

Q.67 Find the blanking force required to punch 10 mm diameter holes in a steel sheet of 3 mm thickness. Given shear strength of material = 400 MPa, penetration = 40% and shear provided on the punch = 2 mm.

(a) 22.6 kN (b) 37.7 kN
 (c) 61.6 kN (d) 94.3 kN

Ans. (a)

Q.68 If the speed of machining combined cemented carbide and steel tool is halved, then the tool life changes by (assume Taylor's exponent = 0.25 for single point turning operation)

- (a) 2 times (b) 4 times
 (c) 8 times (d) 16 times

Ans. (d)

Q.69 In which of the following welding process flux is fed separately?

- (a) Electric arc welding
 (b) Plasma arc welding
 (c) Tungsten inert gas arc welding
 (d) Submerged arc welding

Ans. (d)

Q.70 Which of the following operation does NOT use a jig?

- (a) Tapping (b) Reaming
 (c) Turning (d) Drilling

Ans. (c)

Q.71 In machining operation if path of generatrix and directrix are circular and straight line respectively, the surface obtained will be

- (a) Cylindrical (b) Helical
 (c) Plain (d) Surface of revolution

Ans. (a)

Q.72 Critical path method is good for

- (a) Small projects only
 (b) Large projects only
 (c) Both small and large projects equally
 (d) Neither small nor large projects

Ans. (c)

Q.73 Term "Value" in value engineering refers to

- (a) Total cost of the project
 (b) Selling price of the project
 (c) Utility of the product
 (d) Manufacturing cost of the product

Ans. (c)

Q.74 Classifying items in A, B and C categories for selective control in inventory management is done by arranging items in the decreasing order of

- (a) Total inventory cost
 (b) Item value

- (c) Annual usage value
(d) Item demand

Ans. (c)

Q.75 An industry produces 300 spark plugs in one shift of 8 hours. If standard time per piece is 1.5 minute, the productivity would be

- (a) $\frac{3}{4}$ (b) $\frac{5}{8}$
(c) $\frac{7}{16}$ (d) $\frac{15}{16}$

Ans. (d)

Q.76 In sampling inspection the maximum % defective that can be treated satisfactory as a process average is

- (a) Rejectable Quality Level (RQL)
(b) Acceptable Quality Level (AQL)
(c) Average Outgoing Quality Limit (AOQL)
(d) Lot Tolerance Percent Defective (LTPD)

Ans. (c)

Q.77 A technology for application of mechanical, electronics and computer based systems to control and operate the system is called

- (a) PLC
(b) Sequential controller
(c) Microprocessor based systems
(d) Automation

Ans. (d)

Q.78 Which of the following devices produces incremental motion through equal pulses?

- (a) AC servo motor
(b) DC servo motor
(c) Stepper motor
(d) Series motor

Ans. (c)

Q.79 The degree of freedom of a SCARA robot are

- (a) Six (b) Five
(c) Four (d) Three

Ans. (c)

Q.80 Hall sensor is used to measure the following

- (a) Position of shaft
(b) Angular velocity
(c) Strength of magnetic field
(d) All of the above

Ans. (d)

Q.81 Work done by non-conservative forces on a particle is equal to

- (a) Change in kinetic energy
(b) Change in mechanical energy
(c) Change in potential energy
(d) Change in internal energy

Ans. (a)

Q.82 If a distributed force system on a beam is replaced by its statically equivalent force system, which of the following is same for both the beams?

- (a) Support reactions
(b) Shear force diagram
(c) Bending moment diagram
(d) Maximum bending moment

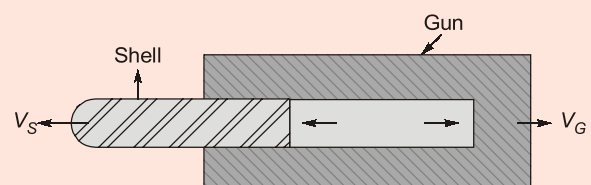
Ans. (a)

Q.83 A simply supported beam of span L is subjected to a moment M_0 at a distance of $\frac{L}{4}$ from the left end. Magnitude of the maximum bending moment in the beam is

- (a) M_0 (b) $\frac{M_0}{2}$
(c) $\frac{M_0}{4}$ (d) $\frac{3M_0}{4}$

Ans. (d)

Q.84 A gun of mass 3000 kg fires horizontally a shell of mass 50 kg with a velocity of 300 m/s. What is the velocity with which the gun will recoil?



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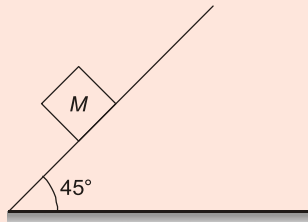
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- (a) -5 m/s (b) 10 m/s
 (c) 50 m/s (d) 30 m/s

Ans. (a)

Q.85 A body of mass (M) 10 kg is initially stationary on a 45° inclined plane as shown in figure below. The coefficient of dynamic friction between the body and inclined plane is 0.5. The body slides down the inclined plane and attains a velocity of 20 m/s. The distance travelled (in meter) by the body along the inclined plane is



- (a) 5.78 m (b) 57.8 m
 (c) 34.6 m (d) 3.46 m

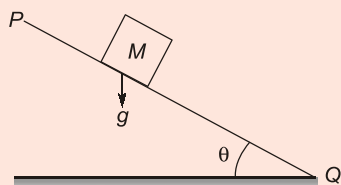
Ans. (b)

Q.86 A simply supported beam of span l carries a uniformly variable load of intensity w_0x over its entire span. Maximum bending moment in the beam is

- (a) $\frac{w_0l^3}{27}$ (b) $\frac{w_0l^3\sqrt{3}}{27}$
 (c) $\frac{w_0l^3\sqrt{2}}{9}$ (d) $\frac{w_0l^3}{9}$

Ans. (b)

Q.87 A block of mass M is released from point P on a rough inclined plane with angle of inclination θ as shown in figure below. The coefficient of friction is μ . If $\mu < \tan \theta$, then the time taken by the block to reach point Q on the inclined plane, where $PQ = S$ is



- (a) $\sqrt{\frac{2S}{g \cos \theta (\tan \theta - \mu)}}$

(b) $\sqrt{\frac{2S}{g \cos \theta (\tan \theta + \mu)}}$

(c) $\sqrt{\frac{2S}{g \sin \theta (\tan \theta - \mu)}}$

(d) $\sqrt{\frac{2S}{g \sin \theta (\tan \theta + \mu)}}$

Ans. (a)

Q.88 Moment of inertia of a thin spherical shell of mass M and radius R , about its diameter is

- (a) MR^2 (b) $\frac{MR^2}{2}$
 (c) $\frac{2}{5}MR^2$ (d) $\frac{2}{3}MR^2$

Ans. (d)

Q.89 Which one of the following can completely balance several masses revolving in different planes on a shaft?

- (a) A single mass in different planes
 (b) A single mass in one of the planes of the revolving masses
 (c) Two masses in any two planes
 (d) Two equal masses in any two planes

Ans. (c)

Q.90 Linear acceleration of slider in slider crank mechanism may be expressed as:

(r = radius of the crank, l = length of the connecting rod and $n = \frac{l}{r}$)

(a) $\omega^2 r \left[\cos \theta + \frac{\sin 2\theta}{n} \right]$

(b) $\omega^2 r \left[\cos \theta + \frac{\cos 2\theta}{n} \right]$

(c) $\omega^2 r \left[\sin \theta + \frac{\sin 2\theta}{n} \right]$

(d) $\omega r \left[\cos \theta + \frac{\cos 2\theta}{n} \right]$

Ans. (b)

Q.91 The effect of the mass of spring can be considered for calculating natural frequency of a spring mass system by adding 'n' times the mass of spring to the main mass. The value of 'n' is

- (a) $\frac{1}{2}$ (b) $\frac{1}{3}$
 (c) $\frac{1}{4}$ (d) $\frac{2}{3}$

Ans. (b)

Q.92 In radial cam translating follower mechanism, the offset is provided to

- (a) Decrease the pressure angle during descent of the follower
 (b) Decrease the pressure angle during ascent of the follower
 (c) Increase the pressure angle during ascent of the follower
 (d) Avoid any obstruction due to other machine parts

Ans. (b)

Q.93 20° full depth involute profile 19 tooth pinion and 37 teeth gear are in mesh. If the module is 5 mm, then the centre distance between the gear pair is

- (a) 140 mm (b) 150 mm
 (c) 280 mm (d) 300 mm

Ans. (a)

Q.94 Initial tension in the belt of a belt drive is T_0 . At the point of maximum power transmission, the belt speed is given by (where m is mass of unit length of belt)

- (a) $\sqrt{\frac{T_0}{m}}$ (b) $\sqrt{\frac{3T_0}{m}}$
 (c) $\frac{T_0}{3m}$ (d) $\sqrt{\frac{T_0}{3m}}$

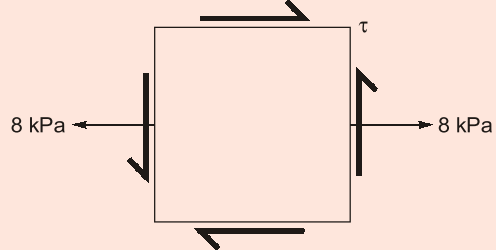
Ans. (d)

Q.95 A cantilever beam, 2 m in length is subjected to a uniformly distributed load of 10 kN/m. If $E = 200$ GPa and $I = 1000$ cm⁴, the strain energy stored in the beam will be

- (a) 7 Nm (b) 12 Nm
 (c) 8 Nm (d) 40 Nm

Ans. (d)

Q.96 For the plane stress state shown below if the largest stress is 10 kPa, find the magnitude of unknown shear stress (τ)



- (a) 3.47 KPa (b) 4.47 KPa
 (c) 5.47 KPa (d) 6.47 KPa

Ans. (b)

Q.97 Consider a two dimensional state stress for an element

where, $\sigma_x = 200$ MPa, $\sigma_y = -100$ MPa

The co-ordinates of the centre of Mohr's circle are

- (a) (0, 0) (b) (100, 200)
 (c) (200, 100) (d) (50, 0)

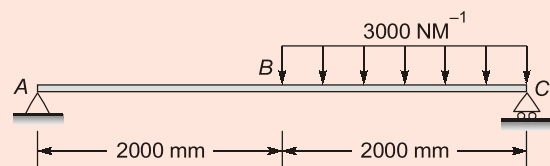
Ans. (d)

Q.98 What is the maximum torque transmitted by a hollow shaft of external radius 'R', internal radius 'r' and maximum allowable shear stress τ ?

- (a) $\frac{\pi}{16}(R^3 - r^3)\tau$ (b) $\frac{\pi}{2R}(R^4 - r^4)\tau$
 (c) $\frac{\pi}{8R}(R^4 - r^4)\tau$ (d) $\frac{\pi}{32}(R^4 - r^4)\tau$

Ans. (b)

Q.99 A massless beam has a loading pattern as shown in the figure. The maximum bending moment occurs at



- (a) Location B
 (b) 2675 mm to the right of A

- (c) 2500 mm to the right of A
(d) 3225 mm to the right of A

Ans. (c)

Q.100 Internal and external radii of a thick cylinder are a and b . It is subjected to an internal pressure of p_i . The radial stress at a radius r in the cylinder is

- (a) $\frac{a^2 p_i}{(b^2 - a^2)} \left(1 - \frac{a^2}{r^2}\right)$
 (b) $\frac{a^2 p_i}{(b^2 - a^2)} \left(1 - \frac{b^2}{r^2}\right)$
 (c) $\frac{b^2 p_i}{(b^2 - a^2)} \left(1 - \frac{a^2}{r^2}\right)$
 (d) $\frac{b^2 p_i}{(b^2 - a^2)} \left(1 - \frac{b^2}{r^2}\right)$

Ans. (b)

Q.101 A shaft is subjected to a bending moment $M = 0.75$ kNm and a twisting moment $T = 1$ kNm. The magnitude of equivalent bending moment in shaft is

- (a) 1.25 kNm (b) 1.125 kNm
(c) 1.0 kNm (d) 0.75 kNm

Ans. (c)

Q.102 If the size of a standard specimen for a fatigue testing machine is increased, the endurance limit for the material will

- (a) Have same value as that of standard specimen
(b) Increase
(c) Decrease
(d) None of the above

Ans. (c)

Q.103 If the load on a ball bearing is halved, its life

- (a) Remains unchanged
(b) Increases two times
(c) Increases four times
(d) Increases eight times

Ans. (d)

Q.104 The deflection of a close coiled helical spring with 20 active turns under a load of 1000 N is 10 mm. The spring is divided into two pieces each of 10 active turns and placed in parallel under the same load. The deflection of this system is

- (a) 20 mm (b) 10 mm
(c) 5 mm (d) 2.5 mm

Ans. (d)

Q.105 Find the dynamic load carrying capacity of a roller bearing if the shaft rotates at 1500 rpm, radial load acting on the bearing is 6 kN and the expected life for 90%, life of the bearing is 8100 hours.

- (a) 6 kN (b) 54 kN
(c) 54000 kN (d) 60000 kN

Ans. (*)43.357 kN

Q.106 If ' w ' is the load on a cylindrical journal of diameter (d) and length (l), then bearing pressure is

- (a) $\frac{2w}{\pi d^2}$ (b) $\frac{4w}{\pi d^2 l}$
(c) $\frac{w}{\pi d l}$ (d) $\frac{w}{d l}$

Ans. (d)

Q.107 δ -iron occurs in the temperature range of

- (a) Between 400°C to 600°C
(b) Between 600°C to 900°C
(c) Between 900°C to 1400°C
(d) Between 1400°C to 1539°C

Ans. (d)

Q.108 Tensile test performed on Universal Testing Machine (UTM) actually measures

- (a) True Stress and True Strain
(b) Young's Modulus and Poisson's ratio
(c) Engineering Stress and Engineering Strain
(d) Load and Elongation

Ans. (d)

Q.109 The process which does NOT improve the fatigue strength of a material is

- (a) Shot peening of the surface
- (b) Electroplating of the surface
- (c) Polishing of the surface
- (d) Cold rolling of the surface

Ans. (b)

Q.110 Which of the following are the advantages of polymer composite materials?

1. Higher Specific Strength
2. Higher Specific Modulus
3. Higher Corrosion Resistance
4. Higher Residual Stresses

- (a) 1, 2, 3
- (b) 1, 2, 4
- (c) 1, 3, 4
- (d) 1, 2, 3, 4

Ans. (d)

Q.111 Stainless steels are highly corrosion resistance due to the presence of

- (a) Chromium
- (b) Manganese
- (c) Molybdenum
- (d) Nickel

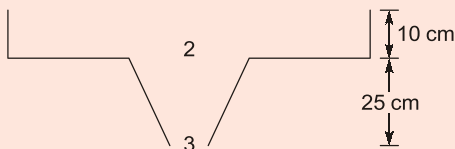
Ans. (a)

Q.112 Packing efficiency of Body Centered Cubic (BCC) crystal is

- (a) 0.68
- (b) 0.74
- (c) 0.50
- (d) 0.65

Ans. (a)

Q.113 For the sprue shown below what should be the area at point 3 in order to avoid aspiration effect? Given area at point 2 = 125 cm².



- (a) 79.05 cm²
- (b) 105.84 cm²
- (c) 66.81 cm²
- (d) 96.82 cm²

Ans. (c)

Q.114 Spring back during the sheet metal operation is caused because of the

- (a) Release of the stored energy during the elastic and plastic deformation

(b) Release of the stored energy during the plastic deformation

(c) Release of the stored energy during the elastic deformation

(d) Excess energy that was utilized during the forming process

Ans. (a)

Q.115 In computer aided part programming by Automatically Program Tool (APT), "COOL NT/ON" is a

- (a) Geometry Statement
- (b) Motion Statement
- (c) Post Processor Statement
- (d) Set up Statement

Ans. (c)

Q.116 An orthogonal cutting operation is being carried out under the following conditions:

Cutting speed = 2 m/sec, Depth of cut = 0.5 mm, Chip thickness = 0.6 mm. What is the chip velocity?

- (a) 2 m/sec
- (b) 2.4 m/sec
- (c) 1 m/sec
- (d) 1.66 m/sec

Ans. (d)

Q.117 Low helix angle drills are used for drilling holes

- (a) Plastics
- (b) Copper
- (c) Cast steel
- (d) Carbon steel

Ans. (d)

Q.118 In Ultrasonic Machining (USM) process the material removal rate will be higher for materials with

- (a) Higher ductility
- (b) Higher fracture strain
- (c) Lower toughness
- (d) Higher toughness

Ans. (c)

Q.119 Which of the following represents the type of fit for a hole and shaft pair? Given that

hole = $50^{+0.04}_{+0.00}$ mm and shaft = $50^{+0.060}_{+0.041}$ mm



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- (a) Clearance fit (b) Loose fit
(c) Transition fit (d) Interference fit

Ans. (d)

Q.120 For machining ceramics, glasses and plastics, which method is NOT applicable?

- (a) LBM (b) AJM
(c) EDM (d) USM

Ans. (c)

Q.121 A comparator for its working depends on

- (a) Accurately calibrated scale
(b) Comparison with standard such as slip gauges
(c) Optical device
(d) Limit gauges

Ans. (b)

Q.122 In machining processes, the percentage of total heat generated in shear action is carried away by the chips to the extent of

- (a) 10% (b) 25%
(c) 50% (d) 80%

Ans. (d)

Q.123 Group Technology brings together and organises

- (a) Parts and simulation analysis
(b) Documentation and analysis
(c) Automation and tool production
(d) Common parts, problems and tasks

Ans. (d)

Q.124 Which of the following layout is used for the manufacturing of large aircrafts?

- (a) Product layout
(b) Process layout
(c) Fixed position layout
(d) Combination layout

Ans. (c)

Q.125 The leaving basic variable in simplex method is the basic variable that

- (a) has the lowest value
(b) has the smallest coefficient in the key row
(c) has the largest coefficient in the key row
(d) goes to zero first, as the entering basic variable is increased

Ans. (b)

