

1. In an open belt drive, the belt is 10 mm thick and has a mass density of 0.001 g/mm^3 . The safe stress in the belt is not to exceed 2.5 N/mm^2 . The centrifugal effect on the belts exists while in motion. The tight side tension is 2400 N. The width of the belt is

- (A) 120 mm
- (B) 95 mm
- (C) 100 mm
- (D) 80 mm

$$T_{\text{max}} = \frac{6 \times W \cdot z}{2400} = 2.5$$

$$\frac{2400}{25} = 16 \times w$$

$$w = 15 \text{ mm}$$

2. Chains

- (A) provide constant velocity ratio and high transmission efficiency
- (B) occupy more space compared to belt drive
- (C) are light in weight as compared to belt
- (D) are used when distance between the shafts is very small

3. With shafts having collinear axes

- (A) rigid or flexible couplings of various forms are used
- (B) clamp coupling cannot be used
- (C) flange coupling cannot be used
- (D) universal coupling is used

4. The diameter of journal in a journal bearing fitted in centrifugal pump is 0.1 m and load on it is 15 kN. The length of the bearing is 0.15 m and its speed is 700 revolutions per minute. The value of bearing modulus obtained from this data using absolute viscosity of lubricating oil as 0.02 N-s/m^2 is

- (A) 13.5
- (B) 15.2
- (C) 14.8
- (D) 14.0

$$\Rightarrow \frac{M \cdot W}{L}$$

$$= \frac{102 \times 700 \times 0.15}{15 \times 10^3 \times 60}$$

5. Roller bearings

- (A) have higher load capacities than ball bearings for a given overall size
- (B) occupy larger space and consist of few number of very large cylindrical rollers
- (C) utilize Sommerfeld number for design purpose
- (D) are widely used in low speed and light duty applications

6. A body is loaded in such a way that the force passes through the centroids of all resisting cross-sections. Therefore, the body is loaded under

- (A) uniformly distributed load
- (B) axial load
- (C) bending
- (D) torsion

7. The coordinates of any point on Mohr's circle represent

- (A) principal stresses at a point
 (B) one of the two direct stresses and shearing stress at a point
 (C) two direct stresses at a point
 (D) state of stress at a point with reference to any arbitrary set of orthogonal axes passing through that point

8. Bulk modulus is

- (A) an independent constant of material and it can be positive or negative
 (B) not a function of Poisson's ratio
 (C) zero for incompressible material
 (D) not an independent constant of material and it is always positive

9. A simply supported beam of 4 m span carries a uniformly distributed load all over the span of 20 kN. The maximum bending moment is

- (A) 15 kN-m
 (B) 12.5 kN-m
 (C) 10 kN-m
 (D) 20 kN-m

10. A neutral plane in a loaded beam is the one

- (A) which is not free from any stress
 (B) which either bends or changes in length
 (C) which neither bends nor changes in length
 (D) where the fibres are neither in compression nor in tension

11. A circular cross-sectional solid shaft is rigidly held at one end and torque is applied at the free end. Material of the shaft is isotropically elastic and homogeneous. Its circular section remains circular after loading. Plane cross-section remains plane after loading. Each cross-section rotates as if rigid. Then

- (A) shear stress will have different values on points lying on the circle of given radius
 (B) shear stress will be maximum at the centre of the section
 (C) shear stress will have the same value at the point lying on the circle of given radius
 (D) shear stress will have the lowest value on the surface



12. In an internally pressurized thick cylinder

(A) hoop stress remains constant but radial stress varies parabolically

(B) both hoop and radial stresses vary linearly

☒ (C) both hoop and radial stresses vary parabolically

(D) hoop stress varies parabolically but radial stress remains constant

13. A close coiled helical spring is subjected to a torque about its axis. The spring wire experiences

(A) direct tensile stress of uniform intensity on its cross-section

(B) direct shear stress

(C) torsional shear stress

☒ (D) bending stress

14. Babbitt's metal is a

☒ (A) tin-based alloy

(B) zinc-based alloy

(C) nickel-based alloy

(D) copper-based alloy

15. Nichrome is an alloy of

(A) nickel, iron and manganese

(B) copper and iron

☒ (C) nickel, chromium and iron

(D) nickel and copper

16. Duralumin

(A) is a beryllium-based alloy used for making springs, electrical switches and bushes of bearings

(B) is similar to Monel metal used for making pump impellers

(C) is an alloy of copper, iron and zinc

☒ (D) is an alloy of aluminium which is extensively used in making automobile and aircraft components

17. The non-ferrous metal alloy used in thermocouples, Wheatstone bridge circuits, lower temperature heaters and resistance is

☒ (A) constantan

(B) phosphor bronze

(C) Inconel

(D) Hastelloy

18. Mild steel belongs to the category of

(A) medium-carbon steel

☒ (B) low-carbon steel

(C) no-carbon steel

(D) high-carbon steel

19. The most commonly used tool material for all purposes is 18-4-1 high-speed steel. It contains

- (A) 18% chromium, 4% tungsten and 1% vanadium
- (B) 18% chromium, 4% vanadium and 1% tungsten
- (C) 18% tungsten, 4% chromium and 1% vanadium
- (D) 18% vanadium, 4% chromium and 1% tungsten

20. In castings, the dendritic structure must be eliminated. The process of

- (A) full annealing is essential
- (B) tempering is essential
- (C) austempering is essential
- (D) normalizing is essential

21. According to binary phase diagram of Fe and Fe_3C , the eutectoid reaction occurs on cooling a steel of 0.8% carbon through the eutectoid temperature (725°C). Then

- (A) by cooling, simply transformation takes place without a compositional change
- (B) by cooling, simply austenite of 0.8% carbon decomposes to a mixture of ferrite (α) of 6.67% carbon and cementite of 0.02% carbon
- (C) by cooling, simply austenite of 0.8% carbon decomposes to a mixture of ferrite (α) of 0.02% carbon and cementite of 6.67% carbon
- (D) fast cooling rate gives fine pearlite

22. Thermoplasts

- (A) are long chain molecules held together by secondary bonds
- (B) have decreasing ability to deform plastically with increasing temperature
- (C) have secondary bonds and as the thermal energy increases, the secondary bonds never break
- (D) have a three-dimensional network of primary bonds as polymerization proceeds in all directions

23. While machining grey cast iron

- (A) continuous chips are produced
- (B) large coils of chips are obtained and chip disposal is a problem
- (C) built-up edge is formed on the cutting edge of the tool
- (D) discontinuous chips are produced

24. In a single-point cutting tool, the side cutting edge angle is

- (A) also known as lead angle
- (B) the angle between the portion of the side flank immediately below the side cutting edge and a line perpendicular to the base of tool, and measured at right angles to the side flank
- (C) also known as complementary angle
- (D) the angle between the end cutting edge and a line normal to the shank

$$r_c = \frac{t}{f_c} \quad g = 4n$$

$$\phi \frac{t}{f_c} = \frac{t_c}{2}$$

25. During metal cutting, the chip thickness ratio

(A) determines the shear angle from the geometry of chip formation

(B) is the ratio

$$\left(\frac{\text{length of uncut chip}}{\text{length of chip}} \right)$$

(C) is the ratio

$$\left(\frac{\text{cutting speed}}{\text{chip velocity}} \right)$$

(D) is always more than 1

26. Grinding

(A) process exerts load on individual cutting grains uniformly

(B) process is intermittent in nature and produces discontinuous chips

(C) wheel has very small number of cutting edges on it

(D) process cannot be used for removing material from materials after hardening

27. Boring

(A) is the process of making hole or enlarging a hole in an object by forcing a rotating tool

(B) machine can never be used for drilling, facing, milling, etc.

(C) cannot correct hole location, size or alignment

(D) is the process of using a single-point tool to enlarge and locate a previously made hole

28. In herringbone gears

(A) lateral thrust is set up by the teeth

(B) lateral or axial thrust is neutralized

(C) motion is transmitted between two non-parallel, non-intersecting shafts which are at right angles

(D) the teeth are parallel with the axis of rotation of the gears

29. Embossing

(A) is a pressing operation

(B) means shaping a metal blank as it revolves at a high speed in a lathe

(C) is mainly employed to improve the fatigue resistance of metal by setting up compressive stresses on the surface

(D) is a forming operation

30. Strain hardening

(A) may be defined as increased hardness accompanying plastic deformation of metal

(B) decreases tensile strength of metal

(C) decreases yield strength of metal

(D) increases ductility and plasticity of metal

31. Work study

- (A) is restricted to shop floor and it may not be applicable anywhere, for example, kitchen, writing desk, gardening, etc.
- (B) includes human work as well as dignity of work
- (C) fails in the elimination of wasteful efforts
- (D) is the study of work and totally includes human work

32. Method study is

- (A) helpful in providing yardstick for human effort
- (B) systematic and it employs an approach involving select—define—break jobs into elements—measure—establish work unit value
- (C) systematic and it employs an approach involving select—record—examine—develop—define—install—maintain
- (D) concerned with the work content of the task itself

33. Batch production is

- (A) suited for the manufacturing of continuous identical parts with very high production rate
- (B) characterized by the low production volume and product variety is generally very high
- (C) used when product variety is very low, which may be one of its kind. Entire plant is designed to cater to a few special varieties of products
- (D) suited for medium volume lot of same variety and at regular intervals, the production order is repeated

34. Cellular layout

- (A) is based on group technology principle and is suitable for a manufacturing environment in which large varieties of products are needed in small volume
- (B) involves various facilities such as machine, equipment, workforce, etc., which are located as per the sequence of operations on parts
- (C) is preferred when production is continuous, part variety is less, production volume is high and part demand is relatively stable
- (D) is also called functional layout and similar machines or similar operations are located at one place

35. Automated guided vehicle



(A) system offers extremely limited flexibility when there is any change in product and in production

(B) system can easily be interfaced with other modules of FMS such as robots, automatic storage and retrieve system, CNC machines, etc.

(C) system is difficult to maintain in any breakdown situation

(D) is unable to select its own route or path to reach destination

36. Production planning

(A) does not cover strategic planning

(B) does not focus on technical planning

(C) includes dispatching, inspection, expediting and evaluation

(D) is a preproduction activity which involves the arrangement of facilities and design of production systems

37. Linear programming

(A) is a technique based on mathematical theory for specifying the ways to use limited resources or constraints of a system to obtain a particular objective when these resources have alternative uses

(B) makes use of non-linear objective function

(C) problems are expressed in the form of non-linear inequalities as constraints

(D) converts a mathematical model into a physical system

38. There is a single doctor in a primary health centre. Patients arrive at the rate of 32 per hour. The time required to provide service is exponentially distributed with mean of 90 seconds. The mean waiting time of a patient, needing medical check-up facility in the queue, is

(A) 8 minutes

(B) 8.5 minutes

(C) 5 minutes

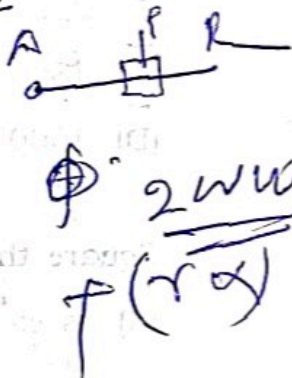
(D) 6 minutes

39. According to Kennedy's theorem, the instantaneous centres of three bodies having relative motion lie on _____

- (A) a circle
- (B) a point
- (C) a parabola
- (D) a straight line

40. A link AR rotates about a fixed point A on it, P is a point on a slider on the link. At any given instant, ω is angular velocity of the link, α is angular acceleration of the link, v is linear velocity of the slider on the link, f is linear acceleration of the slider on the link, r is radial distance of point P on the slider. The acceleration of P perpendicular to AR is _____

- (A) ωv
- (B) $2\omega v + r\alpha$
- (C) $2f + \omega^2 r$
- (D) $f - \omega^2 r$



41. The locus of trace point, if the follower is moved around the cam, is known as _____

- (A) cam circle
- (B) base circle
- (C) pitch curve
- (D) prime circle

42. The mass of a flywheel fitted to a steam engine is 1000 kg. Its radius of gyration is 500 mm. The starting torque of the engine is 1000 N-m and may be considered constant. The flywheel starts from the rest. The kinetic energy of the flywheel after 10 seconds is _____

- (A) 180 kJ
- (B) 230 kJ
- (C) 195 kJ
- (D) 200 kJ

$\text{torque} = 1000 \times 500 \times 10$
 $= 5000000$

$T = I \alpha$
 $\alpha = \frac{T}{I} = \frac{1000}{500^2} = 4$
 $\omega = \alpha t = 4 \times 10 = 40$
 $E = \frac{1}{2} I \omega^2 = \frac{1}{2} \times 500^2 \times 40^2 = 20000000 \text{ J} = 20 \text{ MJ}$

43. The effort of a governor is the force exerted by the governor on the _____

- (A) balls
- (B) upper links
- (C) lower links
- (D) sleeve

$\omega = \alpha t$
 $= 4 \times 10 = 40$
 $1 \times 1000 \times 500 \times 10 = 5000000$
 $\times 40 \times 40 = 80000000$
 $= 80 \text{ MJ}$

44. The number of teeth in a spur gear is 28. This gear has a module of 2 mm and it rotates at 250 r.p.m. Its circular pitch and pitch line velocity are _____

- (A) $\frac{\pi}{2}$ mm and 36000 $\frac{\text{mm}}{\text{min}}$ respectively
- (B) 6.28 mm and 44000 $\frac{\text{mm}}{\text{min}}$ respectively
- (C) 3.14 mm and 42000 $\frac{\text{mm}}{\text{min}}$ respectively
- (D) $\frac{2}{\pi}$ mm and 38100 $\frac{\text{mm}}{\text{min}}$ respectively

$\pi D = \pi \times 56 = 176$
 $\frac{176}{28} = 6.28$
 $250 \times \frac{2\pi \times 56}{60} = 28000$
 $\times 2 = 56000$

45. In reciprocating engines, the primary unbalanced force

- (A) can be fully balanced
- ☒ (B) can be partially balanced
- (C) is maximum when the angle of crank with the line of stroke is 45°
- (D) cannot be balanced

46. The critical speed of a rotating shaft

- (A) depends only on mass of rotor
- (B) is also called calm and quiet speed
- ☒ (C) depends on mass, stiffness and eccentricity of the centre of mass for that rotating shaft
- (D) is independent of stiffness of shaft

47. In a single-degree damped vibrating system, a suspended mass of 5 kg makes 21 oscillations in 11 seconds. The stiffness of the spring will be

- (A) $0.85 \frac{\text{N}}{\text{mm}}$
- (B) $0.60 \frac{\text{N}}{\text{mm}}$
- (C) $0.77 \frac{\text{N}}{\text{mm}}$
- ☒ (D) $0.72 \frac{\text{N}}{\text{mm}}$

48. A double-riveted lap joint is to be made between 10 mm plates with zig-zag arrangement. The diameter of rivet hole is 20 mm. The safe working stresses in shear and tension are 56 N/mm^2 and 80 N/mm^2 respectively. The rivet pitch will be

- (A) 58 mm
- ☒ (B) 64 mm
- (C) 62 mm
- (D) 52 mm

49. The head of a cylinder is subjected to a steam pressure of 0.7 N/mm^2 . The diameter of the cylinder is 0.2 m. The head is held in position by 10 bolts. The external load on each bolt is

- (A) 2000 N
- ☒ (B) 2200 N
- (C) 1800 N
- (D) 1600 N

50. Square thread

- (A) is easier to cut than trapezoidal thread ☒
- (B) has the lowest efficiency as compared to other power screws
- (C) is more sturdy than trapezoidal thread ☒
- ☒ (D) has the highest efficiency as compared to other power screws