7. Choose the most appropriate answer and indicate by writing only the corresponding capital letter (A, B, C, D as the case may be). Answer the items in the sequence in which they appear.

7.1 If 20 percent managers are technocrats, the probability that a random committee of 5 managers consists of exactly 2 technocrats is:

(a) 0.2048 (b) 0.4000 (c) 0.4096 (d) 0.9421

7.2 The actual observed time for an operation was 1 minute per piece. If the performance rating of the operator was 120 and a 5 percent personal time is to be provided, the standard time in minutes per piece is:

(a) 1.000 (b) 1.200 (c) 1.250 (d) 1.263

7.3 In d.c. welding, the straight polarity (electrode negative) results in

(a) lower penetration (b) lower deposition rate

(c) less heating of work piece (d) smaller weld pod

7.4 A shaft (diameter $20^{+0.05}_{-0.15}$ mm) and a hole (diameter $20^{+0.20}_{+0.1}$ mm) when assembled would yield

(a) transition fit (b) interference fit

(c) clearance fit (d) none of these

7.5 In ultrasonic machining process, the material removal rate will be higher for materials with

(a) higher toughness (b) higher ductility

(c) lower toughness (d) higher fracture strain

7.6 A milling cutter having 8 teeth is rotating at 150 rpm. If the feed per tooth is 0.1, the table speed in mm per minute is

(a) 120 (b) 187 (c) 125 (d) 70

7.7 Centrifugally cast products have

(a) large grain structure with high porosity

(b) fine grain structure with high density

(c) fine grain structure with low density

(d) segregation of slug towards the outer skin of the casting

7.8 With reference to NC machines, which of the following statements is wrong.

(a) Both closed-loop and open-loop control systems are used

(b) Paper tapes, floppy tapes and cassettes are used for data storage

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(c) Digitizers may be used as interactive input devices
(d) Post processor is an item of hardware

7.9 A gas turbine cycle with heat exchanger and reheating improves
(a) only the thermal efficiency
(b) only the specific power output
(c) both thermal efficiency and specific power output
(d) neither thermal efficiency nor specific power output

7.10 Knocking tendency in a S.I engine reduces with increasing
(a) compression ratio (b) wall temperature
(c) supercharging (d) engine speed

7.11 The radiative heat transfer rate per unit area (W/m^2) between two plane parallel grey surfaces (emissivity = 0.9) maintained at 400 K and 300 K is:
(a) 992 (b) 812 (c) 464 (d) 567

7.12 Round the clock cooling of an apartment having a load of 300 MT/day requires an air-conditioning plant of capacity about
(a) 1 ton (b) 5 tons (c) 10 tons (d) 100 tons

7.13 The use of Refrigerant-22 (R-22) for temperatures below -30°C is not recommended due to its
(a) good miscibility with lubricating oil
(b) poor miscibility with lubricating oil
(c) low evaporating pressure
(d) high compressor discharge temperature

7.14 The equivalent evaporation (kg/hr) of a boiler producing 2000 kg/hr of steam with enthalpy content of 2426 kJ/kg from feed water at temperature 40°C (liquid enthalpy = 168 kJ/kg, enthalpy of vaporization of water at 100°C = 2258 kJ/kg) is:
(a) 2000 (b) 2149 (c) 1682 (d) 1649

7.15 For a current carrying wire of 20 mm diameter exposed to air ($h = 25\ W/m^2K$), maximum heat distribution occurs when the thickness of insulation ($k = 0.5\ W/m\ K$), is:
(a) 20 mm (b) 10 mm (c) 2.5 mm (d) 0 mm

7.16 Cavitation in a hydraulic turbine is most likely to occur at the turbine
(a) entry (b) exit (c) stator exit (d) rotor exit

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7.17 Specific speed of a Kaplan turbine ranges between

(a) 30 and 60 (b) 60 and 300 (c) 300 and 600 (d) 600 and 1000

7.18 σ_x, σ_y and τ_{xy} are the rectangular stress component at a point. The radius of Mohr's circle is:

(a) $\sqrt{\sigma_x^2 - \sigma_y^2 + \tau_{xy}^2}$

(b) $\sqrt{\left(\frac{\sigma_x + \sigma_y}{2}\right)^2 + \tau_{xy}^2}$

(c) $\sqrt{\sigma_y^2 - \sigma_x^2 + \tau_{xy}^2}$

(d) $\sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$

7.19 $\frac{PL^3}{3EI}$ is the deflection under the load P of a cantilever beam [length L, modulus of elasticity E, moment of inertia I]. The strain energy due to bending is

(a) $\frac{P^2L^3}{3EI}$ (b) $\frac{P^2L^3}{6EI}$ (c) $\frac{P^2L^3}{4EI}$ (d) $\frac{P^2L^3}{48EI}$

7.20. The outside diameter of a hollow shaft is twice its inside diameter. The ratio of its torque carrying capacity to that of a solid shaft of the same material and the same outside diameter is:

(a) $\frac{15}{16}$ (b) $\frac{3}{4}$ (c) $\frac{1}{2}$ (d) $\frac{1}{16}$

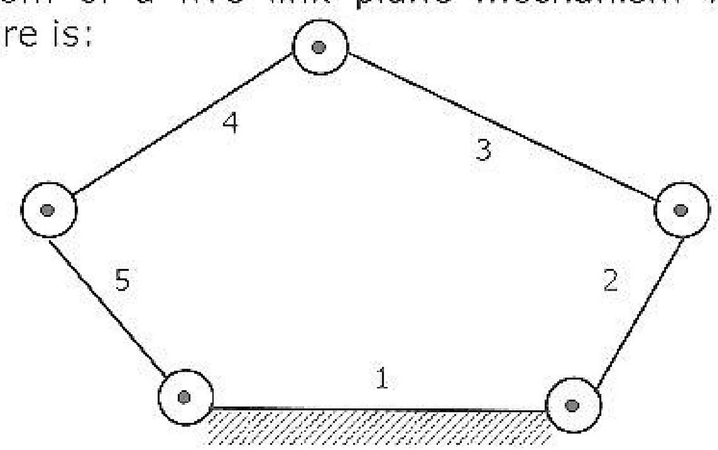
7.21 The number of degrees of freedom of a five link plane mechanism with five revolute pairs as shown in the figure is:

(a) 3

(b) 4

(c) 2

(d) 1



7.22 In a plate cam mechanism with reciprocating roller follower, the follower has a constant acceleration in the case of

(a) cycloidal motion (b) simple harmonic motion

(c) parabolic motion (d) 3-4-5 polynomial motion

7.23 The yield strength of a steel shaft is twice its endurance limit. Which of the following torque fluctuations represent the most critical situation according to Soderberg criterion?

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(a) -T to +T (b) $-\frac{T}{2}$ to $+T$ (c) 0 to +T (d) $+\frac{T}{2}$ to +T

7.24 A cantilver beam of negligible weight is carrying a mass M at its free end, and is also resting on an elastic support of stiffness k_1 as shown in the figure below. If k_2 represents the bending stiffness of the beam, the natural frequency (rad/s) of the system is:

(a) $\sqrt{\frac{k_1 k_2}{M(k_1+k_2)}}$ (b) $\sqrt{\frac{2(k_1+k_2)}{M}}$ (c) $\sqrt{\frac{k_1+k_2}{M}}$ (d) $\sqrt{\frac{k_1-k_2}{M}}$

7.25 The life of a ball-bearing is inversely proportional to

(a) $(\text{Load})^{\frac{1}{3}}$ (b) $(\text{Load})^{3}$ (c) $(\text{Load})^{3.3}$ (d) $(\text{Load})^{2}$

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