

Mechanical Engineering Sample Paper 1

1 In PERT analysis a critical activity has

- A) maximum Float
- B) zero Float
- C) maximum Cost
- D) minimum Cost

Answer : (B)

2 Environment friendly refrigerant R134a is used in the new generation domestic refrigerators. Its chemical formula is

- A) CH C1 F2
- B) C2 C13 F3
- C) C2 C12 F4
- D) C2 H2 F4

Answer : (D)

3 A solid cylinder (surface 2) is located at the centre of a hollow sphere (surface 1). The diameter of the sphere is 1m, while the cylinder has a diameter and length of 0.5 m each. The radiation configuration factor F11 is

- A) 0.375
- B) 0.625
- C) 0.75
- D) 1

Answer : (C)

4 For a fluid flow through a divergent pipe of length L having inlet and outlet radii of R1 and R2 respectively and a constant flow rate of Q, assuming the velocity to be axial and uniform at any cross-section, the acceleration at the exit is

- A) $2Q(R1 - R2) / pLR23$
- B) $2Q2 (R1 - R2) / pLR23$
- C) $2Q2 (R1 - R2) / p2LR25$
- D) $2Q2 (R2 - R1) / p2LR25$

Answer : (C)

5 An incompressible fluid (kinematic viscosity, 7.4×10^{-7} m²/s, specific gravity, 0.88) is held between two parallel plates. If the top plate is moved with a velocity of 0.5 m/s while the bottom one is held stationary, the fluid attains a linear velocity profile in the gap of 0.5 mm between these plates; the shear stress in Pascals on the surface of top plate is

- A) 0.651×10^{-3}
- B) 0.651

- C) 6.51
- D) 0.651×10^3

Answer : (B)

6 The tool of an NC machine has to move along a circular arc from (5,5) to (10,10) while performing an operation. The centre of the arc is at (10,5). Which one of the following NC tool path commands performs the above mentioned operation?

- A) N010 G02 X10 Y10 X5 Y5 R5
- B) N010 G03 X10 Y10 X5 Y5 R5
- C) N010 G01 X5 Y5 X10 Y10 R5
- D) N010 G02 X5 Y5 X10 Y10 R5

Answer : (D)

7 During a Morse test on a 4 cylinder engine, the following measurements of brake power were taken at constant speed.

All cylinders firing 3037 kW

Number 1 cylinder not firing 2102 kW

Number 2 cylinder not firing 2102 kW

Number 3 cylinder not firing 2100 kW

Number 4 cylinder not firing 2098 kW

The mechanical efficiency of the engine is

- A) 91.53%
- B) 85.07%
- C) 81.07%
- D) 61.22%

Answer : (C)

8 In terms of theoretical stress concentration factor (K_t) and fatigue stress concentration factor (K_f), the notch sensitivity 'q' is expressed as

- A) $(K_f - 1) (K_t - 1)$
- B) $(K_f - 1) (K_t + 1)$
- C) $(K_t - 1) (K_f - 1)$
- D) $(K_f + 1) (K_t + 1)$

Answer : (A)

9 Starting from $x_0 = 1$, one step of Newton-Raphson method in solving the equation $x^3 + 3x - 7 = 0$ gives the next value (x_1) as

- A) $x_1 = 0.5$
- B) $x_1 = 1.406$
- C) $x_1 = 1.5$
- D) $x_1 = 2$

Answer : (C)

10 A maintenance service facility has Poisson arrival rates, negative exponential service time and operates on a 'first come first served' queue discipline. Break downs occur on an average of 3 per day with a range of zero to eight. The

maintenance crew can service an average of 6 machines per day with a range of zero to seven. The mean waiting time for an item to be serviced would be

- A) 16 day
- B) 13 day
- C) 1 day
- D) 3 days

Answer : (A)

11 The S-N curve for steel becomes asymptotic nearly at

- A) 103 cycles
- B) 104 cycles
- C) 106 cycles
- D) 109 cycles

Answer : (C)

12 In a rolling process, sheet of 25 mm thickness is rolled to 20 mm thickness. Roll is of diameter 600 mm and it rotates at 100 rpm. The roll strip contact length will be

- A) 5 mm
- B) 39 mm
- C) 78mm
- D) 120mm

Answer : (A)

13 Water at 42°C is sprayed into a stream of air at atmospheric pressure, dry bulb temperature of 40°C and a wet bulb temperature of 20°C. The air leaving the spray humidifier is not saturated. Which of the following statements is true?

- A) Air gets cooled and humidified
- B) Air gets heated and humidified
- C) Air gets heated and dehumidified
- D) Air gets cooled and dehumidified

Answer : (B)

14 The angle between two unit-magnitude coplanar vectors $P(0.866, 0.500, 0)$ and $Q(0.259, 0.966, 0)$ will be

- A) 0°
- B) -30°
- C) 45°
- D) 60°

Answer : (C)

15 A lot has 10% defective items. Ten items are chosen randomly from this lot. The probability that exactly 2 of the chosen items are defective is

- A) 0.0036
- B) 0.1937
- C) 0.2234

D) 0.3874

Answer : (B)

Mechanical Engineering Sample Paper 2

1 Stokes theorem connects

- A) a line integral and a surface integral
- B) a surface integral and a volume integral
- C) a line integral and a volume integral
- D) gradient of a function and its surface integral

Answer : (A)

2 A solar collector receiving solar radiation at the rate of 0.6 k W/m² transforms it to the internal energy of a fluid at an overall efficiency of 50%. The fluid heated to 350 K is used to run a heat engine which rejects heat at 313 K. If the heat engine is to deliver 2.5 kW power, the minimum area of the solar collector required would be

- A) 8.33m²
- B) 16.66m²
- C) 39.68m²
- D) 79.36m²

Answer : (D)

3 When the temperature of a solid metal increases,

- A) strength of the metal decreases but ductility increases
- B) both strength and ductility of the metal decrease
- C) both strength and ductility of the metal increase
- D) strength of the metal increases but ductility decreases

Answer : (A)

4 A company produces two types of toys: P and Q. Production time of Q is twice that of P and the company has a maximum of 2000 time units per day. The supply of raw material is just sufficient to produce 1500 toys (of any type) per day. Toy type Q requires an electric switch which is available @ 600 pieces per day only. The company makes a profit of Rs. 3 and Rs. 5 on type P and Q respectively. For maximization of profits, the daily production quantities of P and Q toys should respectively be

- A) 100, 500
- B) 500, 1000
- C) 800, 600
- D) 1000, 1000

Answer : (C)

5 A spherical thermocouple junction of diameter 0.706 mm is to be used for the measurement of temperature of a gas stream. The convective heat transfer coefficient on the bead surface is 400 W/m²K. Thermophysical properties of thermocouple material are $k = 20$ W/mK, $C = 400$ J/kg K and $\rho = 8500$ kg/m³. If the thermocouple initially at 30°C is placed in a hot stream of 300°C, the time taken by the bead to reach 298°C, is

A) 2.35 s

B) 4.9 s

C) 14.7 s

D) 29.4 s

Answer : (B)

6 In a spring-mass system, the mass is 0.1 kg and the stiffness of the spring is 1 kN/m. By introducing a damper, the frequency of oscillation is found to be 90% of the original value. What is the damping coefficient of the damper?

A) 1.2 N.s/m

B) 3.4 N.s/m

C) 8.7 N.s/m

D) 12.0 N.s/m

Answer : (C)

7 In a machining operation, doubling the cutting speed reduces the tool life to 1/8 of the original value. The exponent n in Taylor

A) 1/8

B) 1/4

C) 1/3

D) 1/2

Answer : (C)

8 In a rolling process, sheet of 25 mm thickness is rolled to 20 mm thickness. Roll is of diameter 600 mm and it rotates at 100 rpm. The roll strip contact length will be

A) 5 mm

B) 39 mm

C) 78 mm

D) 120 mm

Answer : (A)

9 A soldering operation was work-sampled over two days (16 hours) during which an employee soldered 108 joints. Actual working time was 90% of the total time and the performance rating was estimated to be 120 percent. If the contract provides allowance of 20 percent of the total time available, the standard time for the operation would be

A) 8 min

B) 8.9 min

C) 10 min

D) 12 min

Answer : (D)

10 A welding operation is time-studied during which an operator was pace-rated as 120%. The operator took, on an average, 8 minutes for producing the weld-joint. If a total of 10% allowances are allowed for this operation, the expected standard production rate of the weld-joint (in units per 8 hour day) is

A) 45

B) 50

C) 55

D) 60

Answer : (A)

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Mechanical Engineering Sample Paper 3

1 During the execution of a CNC part program block NO20 GO2 X45.0 Y25.0 R5.0 the type of tool motion will be

- A) circular Interpolation — clockwise
- B) circular Interpolation — counterclockwise
- C) linear Interpolation
- D) rapid feed

Answer : (A)

2 A component can be produced by any of the four processes I, II, III and IV. Process I has a fixed cost of Rs. 20 and variable cost of Rs. 3 per piece. Process II has a fixed cost Rs. 50 and variable cost of Re. 1 per piece. Process III has a fixed cost of Rs. 40 and variable cost of Rs. 2 per piece. Process IV has a fixed cost of Rs. 10 and variable cost of Rs. 4 per piece. If the company wishes to produce 100 pieces of the component, from economic point of view it should choose

- A) Process I
- B) Process II
- C) Process III
- D) Process IV

Answer : (B)

3 In an interchangeable assembly, shafts of size $25.000+0.040$ mm mate with holes of size $25.000+0.020$ mm. The maximum possible clearance in the assembly will be

- A) 10 microns
- B) 20 microns
- C) 30 microns
- D) 60 microns

Answer : (D)

4 A company has two factories S1, S2 and two warehouses D1, D2. The supplies from S1 and S2 are 50 and 40 units respectively. Warehouse D1 requires a minimum of 20 units and a maximum of 40 units. Warehouse D2 requires a minimum of 20 units and, over and above, it can take as much as can be supplied. A balanced transportation problem is to be formulated for the above situation. The number of supply points, the number of demand points, and the total supply (or total demand) in the balanced transportation problem respectively are

- A) 2, 4, 90
- B) 2, 4, 110
- C) 3, 4, 90

D) 3, 4, 110

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