2009-ME-'49-60'

AI24BTECH11006 - Bugada Roopansha

49) What are the upper and lower limits of the shaft represented by $60\,f_8$?
Use the following data:
- Diameter 60 lies in the diameter step of 50 – 80 mm.
- Fundamental tolerance unit, i, in μm = $0.45\left(D^{1/3}\right) + 0.001D$, where D is the representative size in mm.
- Tolerance value for $IT8 = 25i$.
- Fundamental deviation for 'f' shaft = $-5.5D^{0.41}$.

a) Lower limit = 59.924 mm, Upper limit = 59.970 mm
b) Lower limit = 59.954 mm, Upper limit = 60.000 mm
c) Lower limit = 59.970 mm, Upper limit = 60.016 mm
d) Lower limit = 60.000 mm, Upper limit = 60.046 mm

50) Match the items in Column I and Column II.

Column I	Column II
Metallic Chills	Support for the core
Metallic Chaplets	Reservoir of the molten metal
Riser	Control cooling of critical sections
Exothermic Padding	Progressive solidification

a) $P-1, Q-3, R-2, S-4$
b) $P-1, Q-4, R-2, S-3$
c) $P-3, Q-4, R-2, S-1$
d) $P-4, Q-1, R-2, S-3$

I. Common Data for Questions 51 and 52:

The inlet and outlet conditions of steam for an adiabatic steam turbine are as indicated in the figure. The notations are as usually followed.
- $h_1 = 3200\,\frac{kJ}{kg}$
- $V_1 = 160\,\frac{m}{s}$
- $Z_1 = 10\,m$
- $P_1 = 3\,MPa$
- $h_2 = 2600\,\frac{kJ}{kg}$
- $V_2 = 100\,\frac{m}{s}$
- $Z_2 = 6\,m$
- $P_2 = 70\,kPa$

51) If mass flow rate of steam through the turbine is $20\,\frac{kg}{s}$, the power output of the turbine ($inMW$) is
a) 12.157
b) 12.941
c) 168.001
d) 168.785

52) Assume the above turbine to be part of a simple Rankine cycle. The density of water at the inlet to the pump is $1000\,\frac{kg}{m^3}$. Ignoring kinetic and potential energy effects, the specific work $\left(in\frac{kJ}{kg}\right)$ supplied to the pump is
a) 0.293
b) 0.351
c) 2.930
d) 3.510

II. Common Data for Questions 53 and 54:

Radiative heat transfer is intended between the inner surfaces of two very large isothermal parallel metal plates. While the upper plate ($designated as plate1$) is a black surface and is the warmer one being maintained at 727°C, the lower plate ($plate2$) is a diffuse and gray surface with an emissivity of 0.7 and is kept at 227°C. Assume that the surfaces are sufficiently large to form a two-surface enclosure and steady-state conditions to exist. Stefan-Boltzmann constant is given as $5.67\times10^{-8}\,\frac{W}{m^2K^4}$.

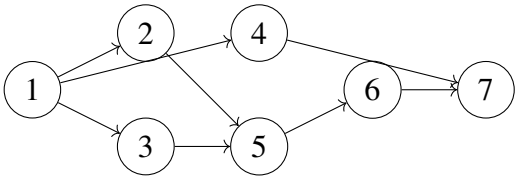
53) The irradiation $\left(in\frac{\text{kW}}{\text{m}^2}\right)$ for the upper plate ($plate1$) is
a) 2.5
b) 3.6
c) 17.0
d) 19.5

54) If plate 1 is also a diffuse and gray surface with an emissivity value of 0.8, the net radiation heat exchange $\left(in\frac{\text{kW}}{\text{m}^2}\right)$ between plate 1 and plate 2 is
a) 17.0

b) 19.5
c) 23.0
d) 31.7

III. Common Data for Questions 55 and 56:

Consider the following PERT network:



The optimistic time, most likely time, and pessimistic time of all the activities are given in the table below:

Activity	**Optimistic time** (*days*)	**Most likely time** (*days*)	**Pessimistic time** (*days*)
1-2	1	2	3
1-3	5	6	7
1-4	3	5	7
2-5	5	7	9
3-5	2	4	6
5-6	4	5	6
4-7	4	6	8
6-7	2	3	4

55) The critical path duration of the network (*indays*) is
a) 11
b) 14
c) 17
d) 18

56) The standard deviation of the critical path is
a) 0.33
b) 0.55
c) 0.77
d) 1.66

IV. Statement for Linked Answer Questions 57 and 58:

In a machining experiment, tool life was found to vary with the cutting speed in the following manner:

57) The exponent (n) and constant (k) of the Taylor's tool life equation are
a) $n = 0.5$ and $k = 540$
b) $n = 1$ and $k = 4860$
c) $n = -1$ and $k = 0.74$
d) $n = -0.5$ and $k = 1.155$

Cutting speed $\left(\frac{m}{min}\right)$	**Tool life** (*minutes*)
60	81
90	36

58) What is the percentage increase in tool life when the cutting speed is halved?
a) 50%
b) 200%
c) 300%
d) 400%

V. Statement for Linked Answer Questions 59 and 60

59) A 20°full depth involute spur pinion of 4 mm module and 21 teeth is to transmit 15 kW at 960 rpm. Its face width is 25 mm.

60) The tangential force transmitted (*inN*) is
a) 3552
b) 2611
c) 1776
d) 1305

61) Given that the tooth geometry factor is 0.32 and the combined effect of dynamic load and allied factors intensifying the stress is 1.5; the minimum allowable stress (*inMPa*) for the gear material is
a) 242.0
b) 166.5
c) 121.0
d) 74.0