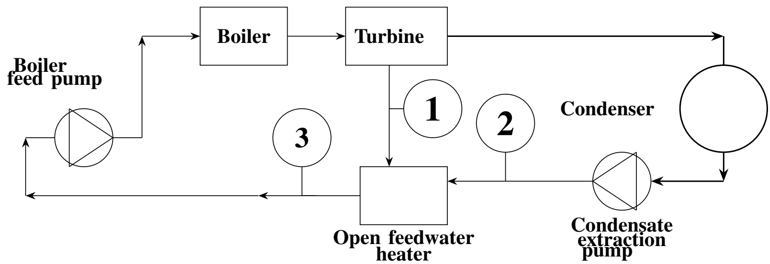
2008-ME

EE24BTECH11033 - KOLLURU SURAJ

1) A thermal power plant operates on a regenerative cycle witha single open feedwater heater, as shown in the figure. For the state points shown, the specific enthalpies are h_1=2800 kJ/kg and h_2=200 kJ/kg. The bleed to the feedwater heater is 20% of the boiler steam generation rate. The specific enthalpy at state 3 is



a) 720 kJ/kg b) 2280 kJ/kg c) 1500 kJ/kg d) 3000 kJ/kg

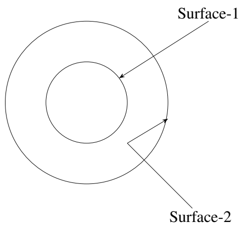
2) Moist air at a pressure of 100 kPa is compressed to 500 kPa and then cooled to 35°C in an aftercooler. The air at the entry to the aftercooler is unsaturated and becomes just saturated at the exit of the aftercooler. The saturation pressure of water at 35°C is 5.628 kPa. The partial pressure of water vapour (in kPa) in the moist air entering the compressor is closest to:

a) 0.57 b) 1.13 c) 2.26 d) 4.52

3) A hollow enclosure is formed between two infinitely long concentric cylinders of radii 1 m and 2 m, respectively. Radiative heat exchange takes place between the inner surface of the larger cylinder (surface-2) and the outer surface of the smaller cylinder (surface-1). The radiating surfaces are diffuse and the medium in the enclosure is non-participating. The fraction of the thermal radiation leaving the larger surface and striking itself is:

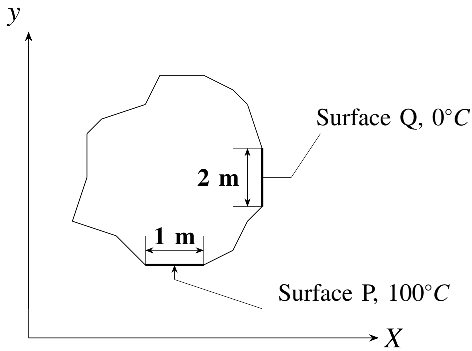
a) 0.25 b) 0.5 c) 0.75 d) 1

4) Air (at atmospheric pressure) at a dry bulb temperature of 40°C and wet bulb temperature of 20°C is humidified in an air washer operating with continuous water recirculation. The wet bulb depression (i.e., the difference between the dry and wet bulb temperatures) at the exit is 25% of that at the inlet. The dry bulb temperature at the exit of the air washer is closest to



a) 10°C b) 20°C c) 25°C d) 30°C

5) Steady two-dimensional heat conduction takes place in the body shown in the figure below. The normal temperature gradients over surfaces P and Q can be considered to be uniform. The temperature gradient $\frac{\partial T}{\partial x}$ at surface Q is equal to 10 K/m. Surfaces P and Q are maintained at constant temperatures as shown in the figure, while the remaining part of the boundary is insulated. The body has a constant thermal conductivity of 0.1 W/m.K. The values of $\frac{\partial T}{\partial x}$ and $\frac{\partial T}{\partial y}$ at surface P are



a) $\frac{\partial T}{\partial x} = 20$ K/m, $\frac{\partial T}{\partial y} = 0$ K/m
b) $\frac{\partial T}{\partial x} = 0$ K/m, $\frac{\partial T}{\partial y} = 10$ K/m
c) $\frac{\partial T}{\partial x} = 10$ K/m, $\frac{\partial T}{\partial y} = 10$ K/m
d) $\frac{\partial T}{\partial x} = 0$ K/m, $\frac{\partial T}{\partial y} = 20$ K/m

6) In a steady state steady flow process taking place in a device with a single inlet and a single outlet, the work done per unit mass flow rate is given by $w = -\int_{\text{inlet}}^{\text{outlet}} v\,dp$, where v is the specific volume and p is the pressure. The expression for w given above

a) is valid only if the process is both reversible and adiabatic
b) is valid only if the process is both reversible and isothermal
c) is valid for any reversible process
d) is incorrect; it must be $w = \int_{\text{inlet}}^{\text{outlet}} p\,dv$

7) For the standard transportation linear programme with m sources and n destinations and total supply equaling total demand, an optimal solution (lowest cost) with the

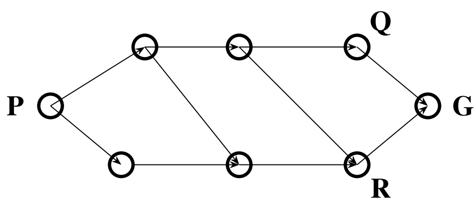
smallest number of non-zero x_{ij} values (amounts from source i to destination j) is desired. The best upper bound for this number is

a) mn
b) $2(m+n)$
c) $m+n$
d) $m+n-1$

8) A moving average system is used for forecasting weekly demand. $F_1(t)$ and $F_2(t)$ are sequences of forecasts with parameters m_1 and m_2, respectively, where m_1 and m_2 ($m_1 > m_2$) denote the numbers of weeks over which the moving averages are taken. The actual demand shows a step increase from d_1 to d_2 at a certain time. Subsequently,

a) neither $F_1(t)$ nor $F_2(t)$ will catch up with the value d_2
b) both sequences $F_1(t)$ and $F_2(t)$ will reach d_2 in the same period
c) $F_1(t)$ will attain the value d_2 before $F_2(t)$
d) $F_2(t)$ will attain the value d_2 before $F_1(t)$

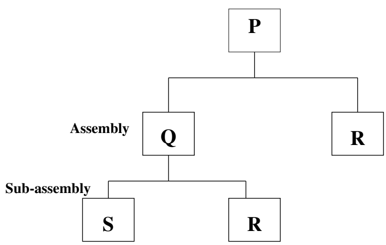
9) For the network below, the objective is to find the length of the shortest path from node P to node G. Let d_{ij} be the length of directed arc from node i to node j.



Let s_j be the length of the shortest path from P to node j. Which of the following equations can be used to find s_G?

a) $s_G = \text{Min}\{s_Q, s_R\}$
b) $s_G = \text{Min}\{s_Q - d_{QG}, s_R - d_{RG}\}$
c) $s_G = \text{Min}\{s_Q + d_{QG}, s_R + d_{RG}\}$
d) $s_G = \text{Min}\{d_{QG}, d_{RG}\}$

10) The product structure of an assembly P is shown in figure



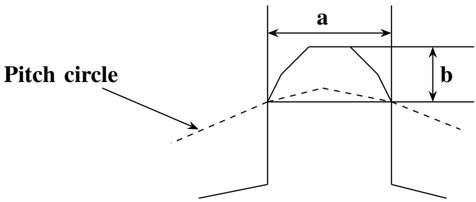
Estimated demand for end product P is as follows:
Ignore lead times for assembly and sub-assembly. Production capacity(per week) for

Week	1	2	3	4	5	6
Demand	1000	1000	1000	1000	1200	1200

component R is the bottleneck operation. Starting with zero inventory, the smallest capacity that will ensure a feasible production plan up to week 6 is

a) 1000 b) 1200 c) 2200 d) 2400

11) One tooth of a gear having 4 module and 32 teeth is shown in figure. Assume that the gear tooth and the corresponding tooth space make equal intercepts on the pitch circumference. The dimensions $'a'$ and $'b'$ respectively, are closest to



a) 6.08 mm, 4 mm
b) 6.48 mm, 4.2 mm
c) 6.28 mm, 4.3 mm
d) 6.28 mm, 4.1 mm

12) While cooling, a cubical casting of side 40 mm undergoes 3%, 4% and 5% volume shirnkage during the liquid state, phase transition and solid state, respectively. The volume of the metal compensated from the riser is

a) 2% b) 7% c) 8% d) 9%

13) In a single point turning tool, the side rake angle and orthogonal rake angle are equal. φ is the principal cutting edge angle and its range is $0° \leq \varphi \leq 90°$. The chip follows in the orthogonal plane. The value of φ is closest to

a) 0° b) 45° c) 60° d) 90°

14) A researcher conducts electrochemical machining (ECM) on a binary alloy$\left(\text{density } 6000\,\text{kg/m}^3\right)$ of iron (atomic weight 56, valency 2) and metal P (atomic weight 24, valency 4). Faraday's constant = 96500 coulomb/mole. Volumetric material removal rate of the alloy is 50 mm^3/s at a current of 2000 A. The percentage of the metal P in the alloy is closest to

a) 40 b) 25 c) 15 d) 79

15) In a single pass rolling oparation, a 20 mm thick plate with plate width of 100 mm, is reduced to 18 mm. The roller radius is 250 mm and rotational speed is 10 rpm.

The average flow stress for the plate material is 300 MPa. The power required for the rolling operation in kW is closest to

a) 15.2 b) 18.2 c) 30.4 d) 45.6

16) In arc welding of a butt joint, the welding speed is to be selected such that highest cooling rate is achieved. Melting efficiency and the heat transfer efficiency are 0.5 and 0.7, respectively. The area of the weld cross section is 5 mm^2 and the unit energy required to melt the metal is 10J/mm^3. If the welding power is 2KW, the welding speed in mm/s is closest to

a) 4 b) 14 c) 24 d) 34

17) In the deep drawing of cups, blanks show a tendency to wrinkle up around the periphery (flange). The most likely cause and remedy of the phenomenon are, respectively,
   a) Buckling due to circumferential compression; Increase blank holder pressure
   b) High blank holder pressure and high friction; Reduce blank holder pressure and apply lubricant
   c) High temperature causing increase in circumferential length; Apply coolant to blank
   d) Buckling due to circumferential compression; decrease blank holder pressure