

Assignment 4

EE24Btech11024 - G. Abhimanyu Koushik

- 1) The function $f(t)$ satisfies the differential equation $\frac{d^2f}{dt^2} + f = 0$ and the auxiliary conditions, $f(0) = 0$, $\frac{df}{dt}(0) = 4$. The Laplace transform of $f(t)$ is given by

(ME 2013)

- a) $\frac{2}{s+1}$ b) $\frac{4}{s+1}$ c) $\frac{4}{s^2+1}$ d) $\frac{2}{s^4+1}$

- 2) Specific enthalpy and velocity of steam at inlet and exit of a steam turbine, running under steady state, are as given below:

	<u>Specific enthalpy (kJ/kg)</u>	<u>Velocity (m/s)</u>
Inlet steam condition	3250	180
Exit steam condition	2360	5

The rate of heat loss from the turbine per kg of steam flow rate is 5 kW . Neglecting changes in potential energy of steam, the power developed in kW by the steam turbine per kg of the steam flow rate is

(ME 2013)

- a) 901.2 b) 911.2 c) 17072.5 d) 17082.5

- 3) A steel ball of diameter 60 mm is initially in thermal equilibrium at 1030°C in a furnace. It is suddenly removed from the furnace and cooled in ambient air at 30°C , with convective heat transfer coefficient $h = 20 \text{ W/m}^2\text{K}$. The thermo-physical properties of steel are: density $\rho = 7800 \text{ kg/m}^3$, conductivity $k = 40 \text{ W/mK}$ and specific heat $c = 600 \text{ J/kgK}$. The time required in seconds to cool the steel ball in air from 1030°C to 430°C is

(ME 2013)

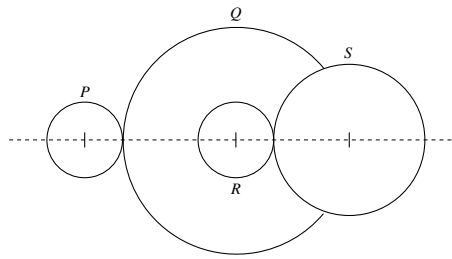
- a) 519 b) 931 c) 1195 d) 2144

- 4) A flywheel is connected to a punching machine has a supply energy of 400 Nm while running at mean angular speed of 20 rad/s . If the total fluctuation of speed is not to exceed $\pm 2\%$, the mass moment inertia of the flywheel in $\text{kg} - \text{m}^2$ is

(ME 2013)

- a) 25 b) 50 c) 100 d) 125

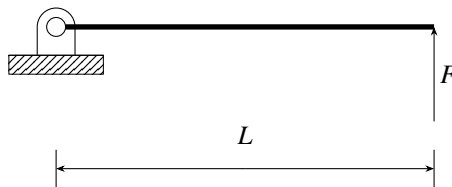
- 5) A compound gear train with gears P , Q , R and S has number of teeth 20, 40, 15 and 20, respectively. Gears Q and R are mounted on the same shaft as shown in the figure below. The diameter of the gear Q is twice that of the gear R . If the module of the gear R is 2 mm , the centre distance in mm between the gears P and S is



(ME 2013)

- a) 40 b) 80 c) 120 d) 160

- 6) A pin jointed uniform rigid rod of weight W and length L is supported horizontally by an external force F as shown in the figure below. The force F is suddenly removed. At the instant of force removal, the magnitude of vertical reaction developed at the support is



(ME 2013)

- a) zero b) $\frac{W}{4}$ c) $\frac{W}{2}$ d) W

- 7) Two cutting tools are being compared for a machine operation. The tool life equations are:

$$\begin{aligned} \text{Carbide tool: } VT^{1.6} &= 3000 \\ \text{HSS tool: } VT^{0.6} &= 200 \end{aligned}$$

where V is the cutting speed in m/min and T is the tool life in min . The carbide tool will provide higher tool life if the cutting speed in m/min exceeds

(ME 2013)

- a) 15.0 b) 39.4 c) 49.3 d) 60.0

- 8) In a CAD package, mirror image of a 2D point $P(5, 10)$ is to be obtained about a line which passes through origin and makes an angle 45° counterclockwise with the X-axis. The coordinates of transformed point will be

(ME 2013)

- a) (7.5, 5) b) (10, 5) c) (7.5, -5) d) (10, -5)

- 9) A linear programming problem is shown below.

$$\text{Maximize } 3x + 7y$$

$$\begin{aligned} \text{Subject to } 3x + 7y &\leq 10 \\ 4x + 6y &\leq 8 \\ x, y &\geq 0 \end{aligned}$$

It has

(ME 2013)

- a) an unbounded objective function.
b) exactly one optimal solution.
- c) exactly two optimal solutions.
d) infinitely many optimal solutions.

10) Cylindrical pins of $25^{+0.020}_{+0.010}$ mm diameter are electroplated in a shop. Thickness of the plate is 30 ± 2.0 micron. Neglecting gauge tolerances, the size of the GO gauge in mm to inspect the plated components is

(ME 2013)

- a) 25.042 b) 25.052 c) 25.074 d) 25.084

11) During the electrochemical machining (ECM) of iron (atomic weight = 56, valency = 2) at current 1000 A with 90% current efficiency, the material removal rate was observed to be 0.26 gm/s. If the Titanium (atomic weight = 48, valency = 3) is machined by ECM process at the current of 2000 A with 90% current efficiency, the expected material removal rate in gm/s will be

(ME 2013)

- a) 0.11 b) 0.23 c) 0.30 d) 0.52

12) A single degree of freedom system having mass 1 kg and stiffness 10 kN/m initially at rest is subjected to an impulse force of magnitude 5 kN for 10^{-4} seconds. The amplitude in mm if the resulting free vibration is

(ME 2013)

- a) 0.5 b) 1.0 c) 5.0 d) 10.0