2021-ME-1-13

EE24BTECH11001 - ADITYA TRIPATHY

1) If $y(x)$ satisfies the differential equation $(\sin x)\frac{dy}{dx} + y\cos x = 1$, subject to the domain $y\left(\frac{\pi}{2}\right) = \frac{\pi}{2}$, then $y\left(\frac{\pi}{2}\right)$ is $(2021-ME)$

a) 0 b) $\frac{\pi}{6}$ c) $\frac{\pi}{3}$ d) $\frac{\pi}{2}$

2) The value of $\lim_{x\to 0}\frac{1-\cos x}{x^2}$ is $(2021-ME)$

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

3) The Dirac-Delta function $\delta(t-t_0)$ for $t, t_0, \in \mathbb{R}$, has the following property

$$\int_a^b \phi(t)\,\delta t - t_0\,dt = \begin{cases}\phi(t_0) & a < t_0 < b\\ 0 & otherwise\end{cases} \tag{1}$$

The laplace transform of the Dirac-Delta function $\delta(t-a)$ for $a > 0$, $\mathcal{L}(\delta(t-a)) = F(s)$ is $(2021-ME)$

a) 0 b) ∞ c) e^{sa} d) e^{-sa}

4) The ordinary differential equation $\frac{dy}{dx} = -\pi y$ subject to an initial condition $y(0) = 1$ is solved numerically using the following scheme:

$$\frac{y(t_{n+1}) - y(t_n)}{h} = -\pi y(t_n) \tag{2}$$

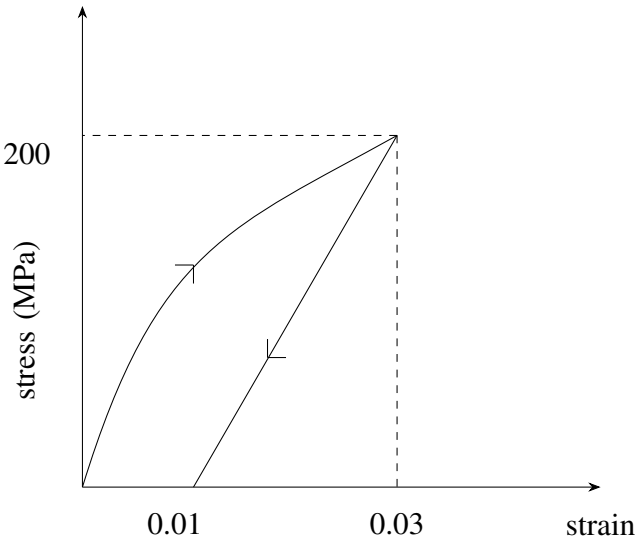
where h is the time step, $t_n = nh$, and $n = 0, 1, 2\cdots$. This numerical scheme is stable for all values of h in the interval $(2021-ME)$

a) $0 < h < \frac{2}{\pi}$ b) $0 < h < 1$ c) $0 < h < \frac{\pi}{2}$ d) for all $h > 0$

5) Consider a binomial random variable X. If $X_1, X_2, \cdots, X_n$ are independent and identically distributed samples from the distribution of X with sum $Y = \sum_{i=1}^{n} X_i$, then distribution of Y as $n \to \infty$ can be approximated as $(2021-ME)$

a) Exponential b) Bernoulli c) Binomial d) Normal

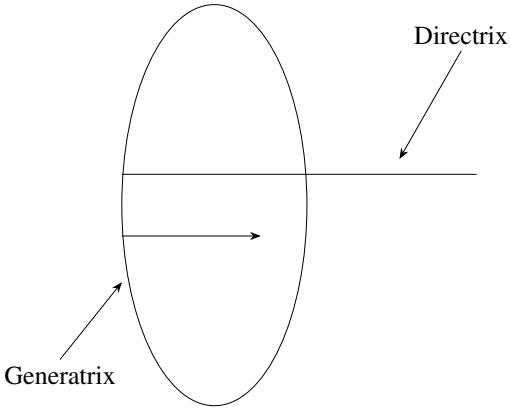
6) The loading and unloading response of a metal is shown in the figure. The elastic and plastic strains corresponding to $200MPa$ stress, respectively, are



(2021 – *ME*)

a) 0.01 and 0.01 b) 0.02 and 0.01 c) 0.01 and 0.02 d) 0.02 and 0.02

7) In a machining operation, if a cutting tool traces the workpiece such that the directrix is perpendicular to the plane of the generatrix as shown in figure, the surface generated is



(2021 – *ME*)

a) plane b) cylindrical c) spherical d) a surface of revolution

8) The correct sequence of machining operations to be performed to finish a large diameter through hole is (2021 – *ME*)

a) drilling, boring, reaming b) boring, drilling, reaming

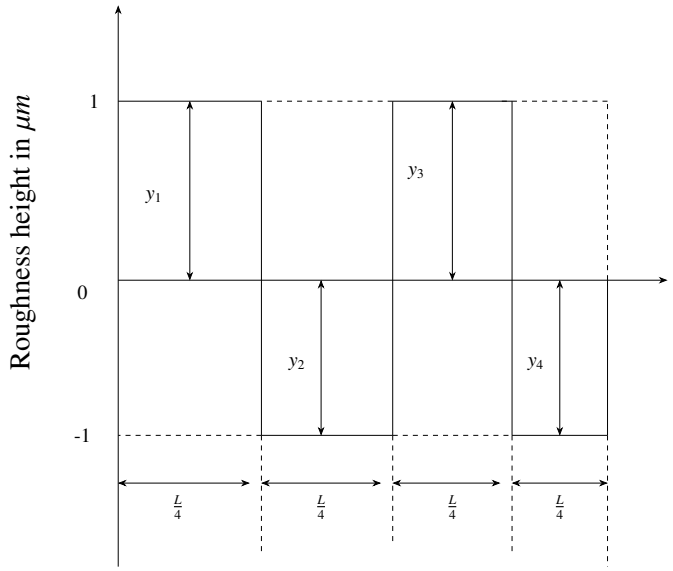
c) drilling, reaming, boring d) boring, reaming, drilling

9) In modern CNC machine tools, the backlash has been eliminated by (2021 – *ME*)

a) preloaded ballscrews b) rack and pinion

c) ratchet and pinion d) slider crank mechanism

10) Consider the surface roughness profile as shown in the figure. The center line average roughness (R_a, in μm)of the measured length (L) is



(2021 – *ME*)

a) 0 b) 1 c) 2 d) 4

11) In which of the following pairs of cycles, both cycles have at least one isothermal process? (2021 – *ME*)

a) Diesel cycle and Otto cycle

b) Carnot cycle and Stirling cycle

c) Brayton cycle and Rankine cycle

d) Bell-Coleman cycle and Vapour compression refrigeration cycle

12) Supeheated steam at $1500kPa$, has a specific volume of $2.75m^3/kmol$ and compressibility factor (Z) of 0.95 . The temperature of steam is (in $^{\circ}C$)
(round off to the nearest integer). (2021 – *ME*)

a) 522 b) 471 c) 249 d) 198

13) A hot steel spherical ball is suddenly dipped into a low temperature oil bath. Which of the following dimensionless parameters are required to determine instantaneous center temperature of the ball using a Heisler chart? (2021 – *ME*)

a) Biot number and Fourier number

b) Reynolds Number and Prandtl number

c) Biot number and Froude number

d) Nusselt number and Grashoff number