S.No. : 01 SP_ME_T_160819

**Material Science, Meterology and Machine Tool**

MADE EASY
India's Best Institute for IES, GATE & PSUs

Delhi | Noida | Bhopal | Hyderabad | Jaipur | Lucknow | Indore | Pune | Bhubaneswar | Kolkata | Patna

**Web:** www.madeeasy.in | **E-mail:** info@madeeasy.in | **Ph:** 011-45124612

# CLASS TEST 2019-2020

## MECHANICAL ENGINEERING

**Date of Test : 16/08/2019**

## ANSWER KEY ➤ Material Science, Meterology and Machine Tool

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1. | (c) | 7. | (b) | 13. | (d) | 19. | (d) | 25. | (b) |
| 2. | (a) | 8. | (a) | 14. | (a) | 20. | (a) | 26. | (d) |
| 3. | (b) | 9. | (a) | 15. | (c) | 21. | (d) | 27. | (b) |
| 4. | (b) | 10. | (a) | 16. | (c) | 22. | (a) | 28. | (b) |
| 5. | (d) | 11. | (b) | 17. | (d) | 23. | (b) | 29. | (b) |
| 6. | (c) | 12. | (a) | 18. | (a) | 24. | (a) | 30. | (c) |

## DETAILED EXPLANATIONS

1. (c)

$$T = \frac{L}{f \times N} = \frac{70}{0.3 \times 75} = 3.11 \text{ minute}$$

2. (a)

$$V = \frac{\pi d N}{1000 \times 60} = \frac{\pi \times 100 \times 450}{1000 \times 60} = 2.356 \text{ m/s}$$

3. (b)

$$V = \frac{NL(1+m)}{1000} = \frac{20 \times 300\left(1+\frac{3}{4}\right)}{1000} = 10.5 \text{ m/min}$$

5. (d)

Table speed = Feed rate = $f_t \times n \times N$
= 0.2 × 10 × 200
= 400 mm/min.

8. (a)

$$BHN = \frac{2P}{\pi D\left[D-\sqrt{D^2-d^2}\right]} = \frac{2 \times 500}{\pi \times 10\left[10-\sqrt{10^2-1.64^2}\right]}$$

= 235.09

11. (b)

Effective diameter, E = T + P

T = Dimensions under the wires = S – ($R_1$ – $R_2$)

S = Standard diameter of cylinder = 30.5 mm

$R_1$ = 13.3768 mm,

$R_2$ = 12.2428 mm

$R_1 - R_2$ = 1.134 mm

∴ T = 30.5 – 1.134 = 29.366 mm

$$P = \frac{p}{2}\cot\frac{x}{2} - d\left[\text{cosec}\frac{x}{2} - 1\right]$$

Where, p = pitch

Here, p = 3.5 mm, x = 60°, d = 2 mm

∴ P = 0.866 p – d = 0.866 × 3.5 – 2 = 1.031 mm

∴ E = T + P = 29.366 + 1.031 = 30.397 mm

14. (a)

$$t_{1max} = \frac{2f}{Nz}\sqrt{\frac{d}{D}}$$

$$t_{2max} = \frac{2f}{Nz}\sqrt{\frac{2d}{2D}}$$

$$t_{2max} = t_{1max}$$

There is no change in maximum uncut thickness

$$t_{2max} - t_{1max} = 0$$

16. (c)

$$\text{Breakthrough distance, } d = \frac{D}{2\tan\alpha} = \frac{12}{2\tan 60^\circ} = 3.464 \text{ mm}$$

$$\text{Drill point angle, } \alpha = 60^\circ$$

$$\text{Total length of travel} = 24 + 3.464 + 3 = 30.464 \text{ mm}$$

$$\text{Time required to drill a hole} = \frac{L}{fN} = \frac{30.464}{0.3 \times 350} \text{ min} = 17.408 \text{ second}$$

17. (d)

$$\text{Gear ratio} = \frac{\text{Lead of job threads}}{\text{Lead of leadscrew}}$$

$$4 = \frac{12 \times 2}{\text{Lead of leadscrew}}$$

$$\text{Lead of leadscrew} = 6 \text{ mm}$$

18. (a)

$$\text{Point angle, } 2\beta = 118^\circ$$

$$(L) \text{ total length} = L_1 + 20 + 1.8 = L_1 + 21.8$$

$$\frac{d/2}{L_1} = \tan 59^\circ$$

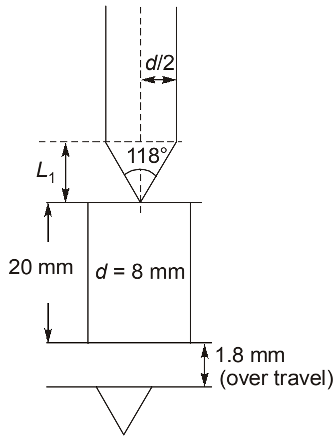
$$L_1 = \frac{8}{2\tan 59^\circ}$$

$$L_1 = 2.403 \text{ mm}$$

$$L = 2.403 + 21.8 = 24.203$$

$$T = \frac{L}{f \times N} = \frac{24.203}{0.2 \times 250} = 0.484 \text{ min}$$

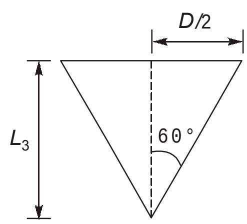
$$= 29.044 \text{ second}$$




20. (a)

$$\tan 60^\circ = \frac{D/2}{L_3}$$

$$L_3 = \frac{D}{2\tan 60^\circ} = \frac{18}{2\tan 60^\circ} = 5.196 \text{ mm}$$




$$L_1 = 2 \text{ mm}, \; L_2 = 3 \text{ mm}, \; L_4 = 25 \text{ mm}$$

$$\text{Total length, } (L) = L_1 + L_2 + L_3 + L_4 = 2 + 3 + 5.196 + 25 = 35.196 \text{ mm}$$

$$f = 0.2 \text{ mm/rev.}$$

$$V = 15 \text{ m/min.}$$

$$\text{Time } (T) = \frac{\pi DL}{1000 f v} = \frac{\pi \times 18 \times 35.196}{1000 \times 0.2 \times 15} = 0.663 \text{ min}$$

22. (a)

$$D = 80 \text{ mm}, \quad z = 8$$
$$V = 20 \text{ m/min}, \quad f = 160 \text{ mm/min}$$
$$d = 2 \text{ mm}$$
$$N = \frac{1000V}{\pi D} = \frac{1000 \times 20}{\pi \times 80} = 79.58 \text{ rpm}$$

Maximum chip thickness,

$$t_{max} = \frac{2f_m}{Nz}\sqrt{\frac{d}{D}} = \frac{2 \times 160}{79.58 \times 8}\sqrt{\frac{2}{80}} = 0.079 \text{ mm}$$

Minimum chip thickness,

$$t_{min} = 0$$
$$t_{avg} = \frac{t_{max} + t_{min}}{2} = 0.0395 \text{ mm}$$

23. (b)

Given: 0.4 thread $\rightarrow$ 1 mm

Pitch of leadscrew, $P = \frac{1}{0.4} = 2.5$ mm

Ratehet has 30 teeth, So,

$\therefore$ Pawl indexes $\frac{1}{30}$ revolution during each stroke

$\therefore$ Feed $= \frac{1}{30} \times 2.5 = 0.083$ mm

24. (a)

$$\sigma_T = \sigma_o + K\varepsilon_T^n \qquad \text{...(i)}$$
$$\Rightarrow \quad \frac{d\sigma_T}{d\varepsilon_T} = 0 + K \cdot n \cdot \varepsilon_T^{n-1}$$
$$= Kn\varepsilon_T^{n-1} \qquad \text{...(ii)}$$

From equation (i)

$$K = \frac{\sigma_T - \sigma_O}{(\varepsilon_T)^n}$$

Substituting the above value in equation (ii)

$$\frac{d\sigma_T}{d\varepsilon_T} = \left(\frac{\sigma_T - \sigma_O}{\varepsilon_T^n}\right)\left(n\,\varepsilon_T^{(n-1)}\right) = \frac{(\sigma_T - \sigma_O)n}{\varepsilon_T}$$
$$= \frac{(300 - 200) \times 0.3}{0.05} = 600 \text{ MPa}$$

27. (b)

Eutectoid is made of 0.8 % C, in iron-iron carbide diagram.

$$\text{Proeutectoid cementite} = \frac{1.4 - 0.8}{6.67 - 0.8} = 0.1022 \simeq 0.10$$

■■■■