Manufacturing Technology Test 1

Number of Questions 35 **Time:60 min.**

Directions for questions 1 to 35: Select the correct alternative from the given choices.

1. The pressure at the ingate will be maximum with the gating system
(A) 1 : 2 : 1 (B) 1 : 2 : 4
(C) 1 : 3 : 3 (D) 4 : 8 : 3

2. Disposable patterns are made of
(A) wood (B) rubber
(C) metal (D) polystyrene

3. In centrifugal casting the lighter impurities are
(A) uniformly distributed
(B) forced towards the outer surface
(C) trapped near the mean radius of the casting
(D) collected at the center of the casting

4. For welding mild steel, the following arc welding is most suitable
(A) *AC*, straight polarity (B) *DC*, straight polarity
(C) *AC*, reverse polarity (D) *DC*, reverse polarity

5. Oxygen to acetylene ratio in case of carburising flame is
(A) 0.5 : 1 (B) 0.9 : 1
(C) 1 : 1 (D) 1 : .2

6. The 'best size wire' for measuring effective diameter of threads is
(A) $\frac{p\sec\theta}{2}$ (B) $\frac{p\cos\theta}{2}$
(C) $\frac{p\cos\theta}{4}$ (D) None of these

Where p = pitch of thread, θ = semi-angle of thread.

7. Negative allowance is provided on the pattern to take care of
(A) the distortion allowance
(B) the draft allowance
(C) the machining allowance
(D) the shake allowance

8. The primary function of a riser is to
(A) allow molten metal to rise above the mould cavity
(B) feed molten metal to casting as it solidifies
(C) allow gases to easily escape from mould cavity
(D) prevent atmospheric air from contaminating the metal in the mould

9. Which of the following arc welding process does not use consumable electrode
(A) GMAW (B) GTAW
(C) SAW (D) None of these

10. In oxyacetylene gas welding, temperature at the inner core of the flame is around
(A) 2550°C (B) 3500°C
(C) 3200°C (D) 2900°C

11. If in a turning operation the feed rate is doubled and nose radius is decreased by half then the new surface finish will be
(A) increased by 8 times (B) decreased by 8 times
(C) increased by 4 times (D) remain unaffected

12. The minimum shear strain in orthogonal turning with a cutting tool of zero rake angle is
(A) 0.00 (B) 0.5
(C) 1.0 (D) 2.0

13. Machinability of steel is improved by the addition of
(A) sulphur (B) silicon
(C) phosphorous (D) All of the above

14. Amount of energy consumption per unit volume of metal removal is maximum in
(A) turning (B) grinding
(C) reaming (D) milling

15. The combination of slip gauges to obtain a dimension of 10.35 mm will be
(A) 10.00 + 0.30 + 0.05
(B) 10.00 + 0.35
(C) 8.00 + 1.30 + 1.05
(D) 5.00 + 4.00 + 1.00 + 0.35

16. In a particular mould, design, the down sprue has an area of cross-section of 7.25 cm^2 where the pouring basin leads in to the sprue. The sprue is 25 cm long. The required metal flow rate at the top section of the sprue is 850 cm^3/s. The pouring height necessary above the sprue top is
(A) 25 cm (B) 32 cm
(C) 7 cm (D) 14 cm

17. Molten aluminium was poured in a sand mould and the thickness of solid skin formed after 25 seconds and 50 seconds were found to be 3 mm and 5 mm respectively. The thickness of the solid skin at the end of 100 seconds after pouring is
(A) 7.8 mm (B) 10 mm
(C) 15.2 mm (D) 25 mm

18. The diameter of a hole is given as $40^{+0.15}_{+0.00}$. The upper limit on the dimension in mm, of the shaft for achieving maximum interference of 50 micron is
(A) 40.05 mm (B) 40.00 mm
(C) 39.95 mm (D) 39.85 mm

19. A cylinder of 20 mm diameter and 100 mm length is turned with a tool, for which the relation $VT^{0.5} = 50$ is applicable. The cutting velocity is 25 m/min. For a tool feed of 0.040 mm /rev, the number of tool regrinds required to produce 500 cylinders is
(A) 25 (B) 85
(C) 125 (D) 196

20. The voltage-arc length characteristics of a power source is $V = 20 + 40\ L$, where V = operating voltage in volts and L = arc length in cm. The open circuit voltage and short circuit current for arc lengths ranging from 2 to 4 mm and current from 300 to 400 amps during welding operation are

(A) 68 V, 850 A (B) 70 V, 800 A
(C) 100 V, 750 A (D) 120 V, 700 A

21. A round billet made of brass is to be extruded (extrusion constant = 250 MPa) at 800°C. The billet diameter is 100 mm and the diameter of the extrusion is 50 mm. The extrusion force requires (in MN) is

(A) 5.25 (B) 4.0
(C) 3.45 (D) 2.72

22. In open die forging, a disc of diameter 100 mm and height 50 mm is compressed without any barreling effect. The final diameter of the disc is 200 mm. The true strain is

(A) 0.987 (B) 1.026
(C) 1.386 (D) 2.506

23. A side and face cutter 120 mm diameter has 10 teeth. It operates at a cutting speed of 15 m/min with a table traverse 100 mm/min. The feed per tooth of the cutter is

(A) 10 mm (B) 8.5 mm
(C) 0.25 mm (D) 0.15 mm

24. Resistance spot welding is performed on two plates of 1.2 mm thickness with 6 mm diameter electrode, using 15000 A current for a time duration of 0.35 sec. Assuming the interface resistance to be 0.0001 Ω, the heat generated to form the weld is

(A) 5000 W (B) 7875 W
(C) 8000 W (D) 9257 W

25. Gating ratio of 1 : 2 : 4 is used to design the gating system for magnesium alloy casting. This gating ratio refers to the cross section areas of the various gating elements as given below.

1. Down sprue
2. Runner
3. Ingates

The sequence of the above elements in the ratio 1 : 2 : 4 is

(A) 1, 2 & 3 (B) 1, 3 & 2
(C) 3, 1 & 2 (D) 2, 3 & 1

26. The height of the down sprue is 180 mm and its cross section area at the base is 200 mm^2. The cross section area of the horizontal runner is also 200 mm^2. Assuming no losses, indicate the correct choice for the time (seconds) required to fill a mould cavity of volume 10^6 mm^3 (use $g = 10$ m/s^2).

(A) 2.66 (B) 3.5
(C) 4.62 (D) 10

27. Match List-1 with List-2 and select the correct option using the code given below the lists.

List-1		List-2	
P.	ECM	1.	Erosion
Q.	USM	2.	Fusion and Vapourization
R.	EDM	3.	Vopourization and ablation
S.	LBM	4.	Ion displacement

	P	*Q*	*R*	*S*
(A)	4	1	2	3
(B)	4	2	1	3
(C)	3	1	2	4
(D)	3	2	1	4

28. Match List – 1 and List - 2

List-1		List-2	
P.	Machining	1.	Wrinkling
Q.	Casting	2.	Heat affected zone
R.	Welding	3.	Hot tear
S.	Drawing	4.	Built up edge

	P	*Q*	*R*	*S*
(A)	1,	2,	3,	4
(B)	4,	1,	2,	3
(C)	3,	2,	4,	1
(D)	4,	3,	2,	1

29. Dry and compressed air is used as cutting fluid for machining.

(A) steel (B) aluminium
(C) cast iron (D) brass

30. Match list-1 (component) with list-2 (manufacturing process) and select the correct answer using the codes given below the lists

List-1		List-2	
P.	Car body (metal)	1.	Machining
Q.	Clutch lining	2.	Casting
R.	Gears	3.	Sheet metal pressing
S.	Engine block	4.	Powder metallurgy.

	P	*Q*	*R*	*S*
(A)	1,	2,	3,	4
(B)	2,	3,	4,	1
(C)	3,	4,	1,	2
(D)	4,	3,	2,	1

31. Match List-1 (crystal structure) with List-2 (example) and select the correct answer using the codes given below the lists

List-1		List-2	
P.	Simple cubic	1.	Zinc
Q.	Body-centered cubic	2.	Copper
R.	Face-centered cubic	3.	Alpha iron at room temperature
S.	Hexagonal closed packed	4.	Manganese.

	P	*Q*	*R*	*S*
(A)	2	1	4	3
(B)	1	2	3	4
(C)	4	3	2	1
(D)	4	3	1	2

Common data for Questions 32 and 33:

In an orthogonal machining experiment using a tool having 7° rake angle, the following data were collected. Cutting speed 0.6 m/sec, width of cut 3 mm, depth of cut 1 mm, chip thickness 1.5 mm. Assuming that shearing takes place under minimum energy condition.

32. The coefficient of friction between the chip tool inter face will be

(A) 0.47 (B) 0.55
(C) 0.68 (D) 0.95

33. Area of shear plane is

(A) 10.2 mm^2 (B) 5.1 mm^2
(C) 3.2 mm^2 (D) 1.5 mm^2

Linked Answer Questions 34 and 35:

In a three wire inspection of external thread of M16 × 2, the measurement over the wires was found to be 16.555 mm.

34. The best wire size is

(A) 2 mm (B) 1.15 mm
(C) 1.0 mm (D) 0.5 mm

35. The effective pitch diameter of the thread is

(A) 16.55 mm (B) 15.02 mm
(C) 14.82 mm (D) 10.25 mm

Answer Keys

1. B	**2.** D	**3.** D	**4.** A	**5.** B	**6.** A	**7.** D	**8.** B	**9.** B	**10.** C
11. A	**12.** D	**13.** D	**14.** B	**15.** C	**16.** C	**17.** A	**18.** A	**19.** D	**20.** A
21. D	**22.** C	**23.** C	**24.** B	**25.** A	**26.** A	**27.** A	**28.** B	**29.** C	**30.** C
31. C	**32.** A	**33.** B	**34.** B	**35.** C					

Hints and Explanations

1. Choice (B)

2. Choice (D)

3. Choice (D)

4. Choice (A)

5.

Flame	Oxygen : acetylene
Carburizing flame	0.9 : 1
Neutral flame	1 : 1
Oxidizing flame	0.5 : 1

Choice (B)

6. Choice (A)

7. Choice (D)

8. Choice (B)

9. Choice (B)

10. Choice (C)

11. From peak to valley height surface finish $R = \frac{f^2}{8r}$

$f_1 = 2f$

$r_2 = r/2$

$\therefore$ new surface finish $= \frac{(2f)^2}{8(r/2)} = \frac{8.f^2}{8r}$

$R_1 = 8R.$ Choice (A)

12. Shear strain $\gamma = \cot\phi + \tan(\phi - \alpha)$

Given that shear angle $\phi = 45°$

Rake angle $\alpha = 0$

$\gamma = \cot 45° + \tan(45 - 0) = 1 + 1 = 2.$

Choice (D)

15.
10.35
1.05 ----------(1)
_____
9.30
1.30 ----------(2)
_____
8.00 ----------(3)
_____

$\therefore$ 8.00 + 1.30 + 1.05 is required combination.

Choice (C)

13. Choice (D)

14. Choice (B)

15. Choice (C)

16. Area of sprue = 7.25 cm^2

Length of sprue (h^2) = 25 cm

Metal flow rate at the top of the sprue = 850 cm^3/s

Q = 850 cm^3/s

$= A_{top} \times V_2$

$V_2 = \frac{Q}{A_{top}} = \frac{850}{7.25} = 117.24$ cm/sec

$V_2 = \sqrt{2gh_b}$

Where h_b = height of molten metal in the pouring basin from top of the sprue

$\therefore \quad h_b = \dfrac{(117.24)^2}{2\times 981} = 7.005$ cm.

Choice (C)

17. The skin thickenss equation in casting is $t = C_1\sqrt{\tau} + C_2$

Where C_1, C_2 are constants, τ = time in seconds

$3 = C_1\sqrt{25} + C_2$

$5 = C_1\sqrt{50} + C_2$

$(5-3) = C_1(\sqrt{50} - \sqrt{25})$

$C_1 = 0.965$; $C_2 = -1.82$

$\therefore$ The thickness of the solid skin after 100 seconds

$t = C_1\sqrt{100} + C_2$

$= 0.965 \times \sqrt{100} - 1.828$

$= 7.822$ mm. Choice (A)

18. Maximum interference = Higher limit of shaft – Lower limit of hole

$0.05 = H.L.S - 40$

$H.L.S = 40 + 0.05 = 40.05$ mm Choice (A)

19. $D = 20$ mm $V_c = 25$ m/min

$L = 100$ mm $f = 0.040$ mm/rev

$VT^{0.25} = 50$

$N = \dfrac{1000V}{\pi D} = \dfrac{1000\times 25}{\pi\times 20} = 397.87$ rpm

Time per piece $= \dfrac{L}{fN} = \dfrac{100}{0.040\times 397.87}$

$= 6.283$ min

Total time $= 500 \times 6.283 = 3141.59$ min

And also

$T = \left(\dfrac{50}{V}\right)^{\frac{1}{0.25}} = \left(\dfrac{50}{25}\right)^{\frac{1}{0.25}} = 16$

$\therefore$ Number of tool regrinds $= \dfrac{3141.59}{16} = 196$

Choice (D)

20. $V = 20 + 40$ L

When $L = 2$ mm, $I = 300$

When $L = 4$ mm, $I = 400$

$V = V_0 - \dfrac{V_0}{I_s}(I)$

When $L = 0.2$ cm, $V = 20 + 40 \times 0.2 = 28$

$\therefore \quad 28 = V_0 - \dfrac{V_0}{I_s}(300)$ ----------(1)

When $L = 0.4$ cm, $V = 20 + 40 \times 0.4 = 36$

$36 = V_0 - \dfrac{V_0}{I_s}(400)$ ------(2)

From (1) and (2)

$28 = V_0 - \dfrac{V_0}{\mathrm{I}_s}(300)$

$36 = V_0 - \dfrac{V_0}{\mathrm{I}_s}(400)$

$(28-36) = \dfrac{-V_0}{\mathrm{I}_s}(300-400)$

$-8 = \dfrac{V_0}{\mathrm{I}_s}(-100)$

$\dfrac{V_0}{\mathrm{I}_s} = \dfrac{8}{100}$

$36 = V_0 - \dfrac{8}{100}\times 400$

$V_0 = 36 + 32 = 68$

$I_s = \dfrac{V_0\times 100}{8} = \dfrac{68\times 100}{8} = 850$ amp

$V_0 = 68$ V

$I_s = 850$ amps Choice (A)

21. Extrusion constant (k) = 250

Billet diameter $d_b = 100$ mm

Diameter of extrusion $d_e = 50$ mm

Extrusion force $= A_b\, k\, \ell n\left(\dfrac{A_b}{A_e}\right)$

$= \dfrac{\pi}{4}100^2 \times 250 \times \ell n\left(\dfrac{100}{50}\right)^2$

$= 2.72$ MN Choice (D)

22. initial diameter $d_i = 100$ mm

final diameter $d_0 = 200$ mm

Initial height $h_i = 50$ mm

True strain $= \ell_n\left(\dfrac{A_f}{A_i}\right) = \ell_n\left(\dfrac{d_f}{d_i}\right)^2$

$= 2\ \ell n\left(\dfrac{200}{100}\right)$

$= 1.386$ Choice (C)

23. number of teeth $Z = 10$

cutting speed $V = 15$ m/min

$V = \pi DN$

$N = \dfrac{V}{\pi D} = \dfrac{15\times 1000}{\pi\times 120} = 39.788$ r.p.m

Feed per tooth $= \dfrac{L}{NZ} = \dfrac{100}{39.788\times 10}$

$= 0.25$ mm/tooth Choice (C)

24. $t = 1.2$ mm

$d = 6$ mm

$I = 15000$ A

$\tau = 0.35$ sec
$R = 0.0001\tau$
Heated generated $Q = I^2R\tau$
$= 15000^2 \times 0.0001 \times 0.35$
$= 7875$ W-sec Choice (B)

25. Hint : "SRI"
Sprue : Runner : Ingate Choice (A)

26. $h = 180$ mm

$V_{max} = \sqrt{2gh} = \sqrt{2\times9810\times180} = 1879.255$ mm/sec

$$\text{Pouring time} = \frac{Volume}{A\times V_{max}} = \frac{10^6}{200\times1879.255}$$

$= 2.66$ sec Choice (A)

27. $P - 4$, $Q - 1$, $R - 2$, $S - 3$ Choice (A)

28. Choice (B)

29. Choice (C)

30. Choice (C)

31. Choice (C)

32. rake angle $\alpha = 7°$
cutting velocity $V_c = 0.05$ m/s
width of cut $(w) = (B) = 3$ mm
$t_1 = 1$ mm
$t_2 = 1.5$ mm

$$\text{chip thickness ratio } (r) = \frac{t_1}{t_2} = \frac{1}{1.5} = 0.67$$

$$\text{shear angle } \phi = \tan^{-1}\left(\frac{0.67\cos 7}{1-0.67\sin 7}\right)$$

$\phi = 35.9°$
And also
$\beta = 90 + \alpha - 2\phi = 90 + 7 - 2\times 35.9$
$= 25.2$
Coefficient of friction $\mu = \tan\beta$
$= \tan(25.2)$
$= 0.47$ Choice (A)

33. Area of shear plane $A_s = L_s \times B$

$$= \frac{t_1 \times B}{\sin\varphi}$$

$$= \frac{1\times3}{\sin(35.9)} = 5.11 \text{ mm}^2$$ Choice (B)

34. Pitch = 2 mm
$\alpha = 30°$

$$\text{The best wire size, } d = \frac{p}{2}\sec\alpha$$

$$= \frac{2}{2}\sec 30$$

$= 1.155$ mm. Choice (B)

35. $$\text{The effective diameter} = M - \left(d + \frac{p}{2}\tan\alpha\right)$$

Where M = measurement over the wires
$M = 16.555$ mm

$$= 16.555 - \left(1.55 + \frac{2}{2}\times\tan 30\right)$$

$= 14.82$ mm Choice (C)