CLASS TEST

Sl.: 01DLSK_ME_ABCDEFG_24426

MADE EASY

Leading Institute for IES, GATE & PSUs

Delhi | **Bhopal** | **Hyderabad** | **Jaipur** | **Pune**

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

INDUSTRIAL ENGINEERING

MECHANICAL ENGINEERING

Date of Test : 24/04/2026

ANSWER KEY

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

DETAILED EXPLANATIONS

1. (a)

When a demand pattern is consistently increasing or decreasing, Regression analysis is very useful forecasting technique.

2. (b)

Large size of inventory is a sign of
- poor scheduling
- inefficient planning
- vendors are not well-coordinated

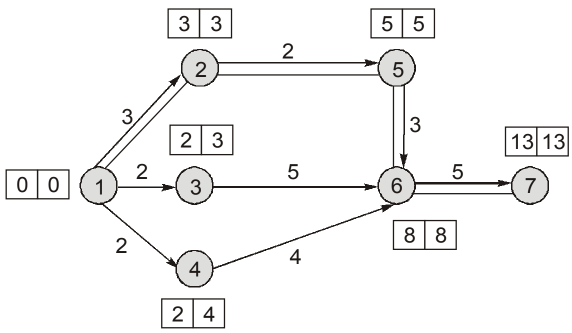
3. (b)

$$\lambda \text{ (Arrival rate)} = 3/\text{hour}$$
$$\mu \text{ (Service rate)} = 10/\text{hour}$$
$$\rho = \frac{\lambda}{\mu} = \left(\frac{3}{10}\right) = 0.3$$
$$\text{Queue length} = \left(\frac{\rho^2}{1-\rho}\right) = \frac{(0.3)^2}{1-0.3} = 0.129$$

4. (c)

5. (a)

6. (c)



Critical path is 1 – 2 – 5 – 6 – 7.

7. (d)

At break even point

Fixed price + variable price= Total Revenue

$$400000 + 20\,N = 30\ N$$
$$10\,N = 400{,}000$$
$$N = 40000 \text{ units}$$

$$\text{Margin of safety} = \frac{\text{Total sales} - \text{sales at B.E.P.}}{\text{Total sales}}$$

$$= \frac{1500000-(40000\times 30)}{1500000}\times 100 = 20\,\%$$

8. (d)

Number of orders = 12

$$Q^* = \frac{7200}{12} = 600$$

$$\text{Average inventory} = \frac{600}{2} = 300 \text{ units}$$

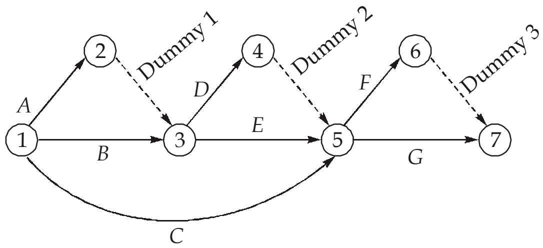
9. (b)

10. (d)

$$\text{RSFE} = \sum_{i=1}^{n}(D_i - F_i)$$

11. (c)

Network diagram:



12. (b)

Total float = $L_j - (E_i + t_{Eij}) = 19 - (5 + 10) = 4$

Independent float = $E_j - (L_i + t_{Eij}) = 17 - (6 + 10) = 1$

T.F. – I.F. = 4 – 1

T.F – I.F. = 3

13. (b)

	S_1	S_2	S_3
P	60	95	105
Q	85	70	110
R	90	100	80

Step 1 : Subtract minimum entry in each row from all the entries on that row,

	S_1	S_2	S_3
P	0	35	45
Q	15	0	40
R	10	20	0

Step 2 : Making the assignment

[0]	35	45
15	[0]	40
10	20	[0]

The minimum cost = 60 + 70 + 80 = ₹ 210

14. **(c)**

15. **(a)**

$$(TC)_1 = \left(\frac{45}{60}+\frac{25}{60}x\right)200$$

$$(TC)_2 = \left(2.5+\frac{5x}{60}\right)800$$

At BEP: $(TC)_1 = (TC)_2$

or $$\left(\frac{45}{60}+\frac{25}{60}x\right)200 = \left(2.5+\frac{5x}{60}\right)800$$

or $$\frac{45}{60}+\frac{25x}{60} = 10+\frac{20x}{60}$$

or $5x = 600 - 45 = 555$

or $x = 111$ units

16. **(b)**

Given: Variables, n = 4 variables

Constraints, m = 2 equations

$n - m = 2$

$$^nC_m = \frac{n!}{m!(n-m)!} = \frac{4!}{2!2!} = 6 \text{ corner points}$$

17. **(a)**

Total time = 15 + 10 + 12 + 13 + 15 + 9 = 74

Cycle time = 15

$$\text{Line efficiency} = \frac{\text{Total time}}{\text{Cycle time} \times \text{No. of work station}} = \frac{74}{15\times 6} \simeq 82\%$$

18. **(c)**

For 200 units of A.

Units of P = 2 × 200 = 400 units

Net requirement of P = 400 – 20 = 380 units

for 1 units of P, units of S required = 4

Net requirement of S = 4 × 380 – 10 = 1520 – 10 = 1510 units

19. **(b)**

Using Johnson's rule the optimal sequence is :

4 - 1 - 3 - 2 - 5 - 6

Job	Turning		Threading	
	In	Out	In	Out
4	0	2	2	8
1	2	5	8	16
3	5	10	16	25
2	10	22	25	35
5	22	31	35	38
6	31	42	42	43

Optimal MST = 43 min

20. **(b)**

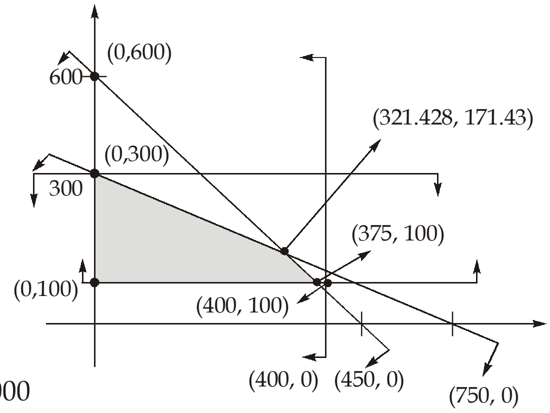
Profit, $Z = 30x + 40y$

$1.6x + 1.2y \leq 720$

$1.2x + 3y \leq 900$

$x \leq 400$

$100 \leq y \leq 300$



$1.6x + 1.2y \leq 720$

$1.2x + 3y \leq 900$

$x = 321.428$

$y = 171.488$

$P_{(0,\ 300)} = 30 \times 0 + 300 \times 40 = ₹12000$

$P_{(375,\ 100)} = 375 \times 30 + 100 \times 40 = ₹15250$

$P_{(321.428,\ 171.428)} = 321.428 \times 30 + 171.428 \times 40$

$= 16499.96 \simeq ₹16500$

Point (400, 100) is outside of feasible region.

$P_{(0,\ 100)} = 30 \times 0 + 100 \times 40 = ₹4000$

So, maximum profit is ₹ 16500.

21. **(b)**

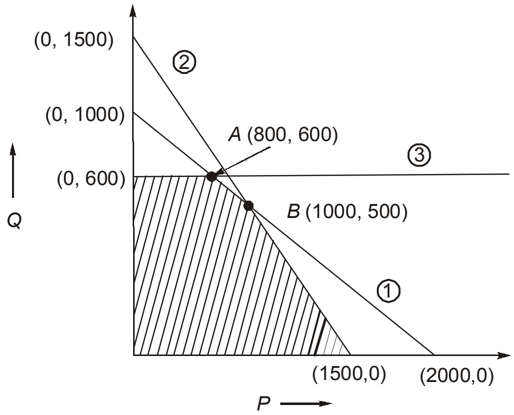
$$F_{July} = 0.1 \times D_{Mar} + 0.2 \times D_{Apr} + 0.3 \times D_{Mar} + 0.4 \times D_{June}$$

$$= 0.1 \times 300 + 0.2 \times 250 + 0.3 \times 310 + 0.4 \times 170 = 241$$

22. (a)

Given
$$P + 2Q \le 2000 \quad ...(i)$$
$$P + Q \le 1500 \quad ...(ii)$$
$$Q \le 600$$

Objective function
$$z_{max} = 3P + 5Q$$



At point A $\quad z = 3 \times 800 + 600 \times 5 = 5400$

At point B $\quad z = 3 \times 1000 + 5 \times 500 = 5500$

Hence z to be maximum at (1000, 500)

23. (c)

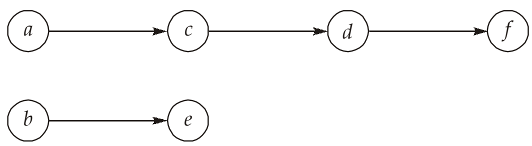
As per SPT, optimal sequence is

E – D – F – B – A – C

Respective completion time 3, 7, 12, 18, 25 and 33

Completion time for job A = 25 minutes

24. (c)



Expected production rate = 500 units per shift of 4 hour duration

$$\text{Time to produce a unit} = \frac{4 \times 3600}{500}\text{seconds} = 28.8 \text{ seconds}$$

Station	Task	Station time
1	*a, c*	10 + 15 = 25 < 28.8
2	*b, d*	20 + 5 = 25 < 28.8
3	*e, f*	8 + 12 = 20 < 28.8

So, atleast we need 3 workstations.

Alternate solution:

$$\Sigma T_i = 10 + 20 + 15 + 5 + 8 + 72 = 70$$

$$\text{Time to produce a unit} = \frac{4 \times 3600}{500} = 28.8 \text{ seconds}$$

$$\text{Number of work-stations} = \frac{70}{28.8} = 2.43 \simeq 3 \text{ work-stations}$$

25. (a)

Using SPT rule:

Jobs	Processing time	Due date	Job flow time
D	6	13	6
A	7	9	13
B	9	17	22
E	11	26	33
C	13	10	46

$$\text{Average job flow time} = \frac{46+33+22+13+6}{5} = \frac{120}{5} = 24$$

Using EDD Rule:

Jobs	Processing time	Due date	Job flow time
A	7	9	7
C	13	10	20
D	6	13	26
B	9	17	35
E	11	26	46

$$\text{Average job flow time} = \frac{7+20+26+35+46}{5} = 26.8$$

$$\frac{\text{Average job flow time using SPT rule}}{\text{Average job flow time using EDD rule}} = \frac{24}{26.8} = 0.895$$

26. (d)

27. (b)

Given: $\lambda = 30$ trains per day

$$\mu = \frac{60 \times 24}{36} = 40 \text{ trains per day}$$

$$\text{System utilization, } \rho = \frac{\lambda}{\mu} = \frac{30}{40} = 0.75$$

$\because$ Probability that queue size exceed 10,

$$P(\geq 10) = \rho^{10} = (0.75)^{10} = \mathbf{0.056}$$

28. (d)

Given: $D = 400$; $C = ₹\ 50$; $C_0 = ₹\ 75$; $C_h = 0.1 \times 50 = ₹\ 5$ per week

$$\text{Total cost} = D \times C + \sqrt{2 \times D \times C_0 \times C_h}$$

$$= 400 \times 50 + \sqrt{2 \times 400 \times 75 \times 5} = ₹\ 20547.72 \simeq ₹\ 20548$$

29. **(c)**

30. **(a)**

Distribution centres

		1	2	3	4	Supply
	1	2 (6)	3	11	7	6/0
Plants	2	1 (1)	0 (0)	6	1	1/0
	3	5	8 (5)	15 (3)	9 (2)	10/5/2/0
Requirement		7/1/0	5/0	3/0	2/0	

$$\text{Minimum cost} = [2 \times 6 + 1 \times 1 + 8 \times 5 + 15 \times 3 + 9 \times 2] \times 100 = \text{Rs. } 11600$$

■■■■