



**POSTAL
BOOK PACKAGE**

2025

CONTENTS

**MECHANICAL
ENGINEERING**

Objective Practice Sets

Industrial Engineering

1.	Break-even Analysis	2 - 7
2.	Inventory Control	8 - 20
3.	PERT and CPM	21 - 30
4.	Forecasting	31 - 40
5.	Queuing Theory	41 - 46
6.	Linear Programming, Transportation and Assignment Models	47 - 59
7.	Line Balancing and Sequencing	60 - 69
8.	Plant layout, Product development and MRP	70 - 84
9.	Quality Analysis & Control and Work study	85 - 90

Plant layout, Product development and MRP

MCQ and NAT Questions

- Q.1** If in a project various activities demand varying levels of resources and the constraint is such that demand on certain specified resource should not go beyond a prescribed level. The operation of resource allocation is called
 (a) Resource smoothing (b) Resource levelling
 (c) Networking (d) updating
- Q.2** Product structure in process industries is likely to be
 (a) horizontal (b) vertical
 (c) Tree type (d) None of these
- Q.3** The characteristic life-cycle of a product consists of four periods. The rate of consumption increases rapidly at the beginning of the
 (a) Incubation period (b) Growth period
 (c) Maturity period (d) Decline period
- Q.4** Which one of the following correctly explains process capability?
 (a) Maximum capacity of the machine
 (b) Mean value of the measured variable
 (c) Lead time of the process
 (d) Maximum deviation of the measured variables of the components
- Q.5** The type of layout suitable for use of the concept, principles and approaches of 'group technology' is
 (a) Product layout
 (b) Job-shop layout
 (c) Fixed position layout
 (d) Cellular layout
- Q.6** Which of the following is/are advantages of cellular manufacture?
 1. Lower work-in-progress inventories
 2. Fewer tooling changes
 Select the correct answer using the code given below:
 (a) 1 only (b) 2 only
 (c) Both 1 and 2 (d) Neither 1 nor 2
- Q.7** During manufacturing of cement, the handling of limestone is done by
 (a) belt conveyor (b) bucket conveyor
 (c) overhead crane (d) fork-lift crane
- Q.8** Which one of the following combinations is valid for product layout?
 (a) General purpose machine and skilled labour
 (b) General purpose machine and unskilled labour
 (c) Special purpose machine and semi-skilled labour
 (d) Special purpose machine and skilled labour
- Q.9** The curve representing the level of achievement with reference to time is known as
 (a) Performance curve
 (b) Operating characteristic curve
 (c) S-curve
 (d) Learning curve
- Q.10** The reason for diversification is to
 (a) reduce production cost
 (b) balance low demand high capacity situation
 (c) satisfy more customers
 (d) improve capacity utilization
- Q.11** Which one of the following types of layout is used for the manufacture of huge aircrafts?
 (a) Product layout
 (b) Process layout
 (c) Fixed position layout
 (d) Combination layout
- Q.12** The span of control refers to the
 (a) Total amount of control which can be exercised by the supervisor.
 (b) Total number of persons which report to any one supervisor
 (c) Delegation of authority by the supervisor to his subordinates
 (d) Delegation of responsibility by the supervisor to his subordinates

Answers Plant layout, Product development and MRP

- | | | | | | | | | |
|---------|---------|---------|---------|---------|---------|------------|---------|---------|
| 1. (b) | 2. (b) | 3. (b) | 4. (d) | 5. (d) | 6. (c) | 7. (a) | 8. (c) | 9. (d) |
| 10. (b) | 11. (c) | 12. (c) | 13. (a) | 14. (b) | 15. (d) | 16. (d) | 17. (c) | 18. (b) |
| 19. (a) | 20. (b) | 21. (b) | 22. (b) | 23. (c) | 24. (a) | 25. (d) | 26. (c) | 27. (d) |
| 28. (c) | 29. (d) | 30. (b) | 31. (c) | 32. (d) | 33. (c) | 34. (b) | 35. (a) | 36. (d) |
| 37. (a) | 38. (c) | 39. (c) | 40. (d) | 41. (b) | 42. (b) | 43. (c) | 44. (d) | 45. (c) |
| 46. (a) | 47. (d) | 48. (c) | 49. (d) | 50. (d) | 51. (c) | 52. (c) | 53. (a) | 54. (b) |
| 55. (c) | 56. (a) | 57. (b) | 58. (b) | 59. (c) | 60. (d) | 61. (a) | 62. (c) | 63. (a) |
| 64. (c) | 65. (c) | 66. (d) | 67. (c) | 68. (d) | 69. (b) | 70. (a) | 71. (c) | 72. (d) |
| 73. (b) | 74. (a) | 75. (a) | 76. (a) | 77. (a) | 78. (d) | 79. (a) | 80. (d) | 81. (c) |
| 82. (c) | 83. (d) | 84. (c) | 85. (d) | 86. (a) | 87. (d) | 88. (a, b) | | |

Explanations Plant layout, Product development and MRP**1. (b)**

The operation of resource allocation in which various demands are met within prescribed resources acting as constraints, is called resource levelling.

2. (b)

In process industries, various operations are done at specific locations, so product structure is likely to be vertical in order to use floor space as much as possible.

3. (b)

In product life-cycle, rate of consumption increases rapidly at the beginning of the growth period.

4. (d)

Process capability means the difference between highest and lowest values of the measured variables of the components.

5. (d)

Cellular layout is suitable for use of the concept, principles and approaches of 'group technology'.

6. (c)

Cellular manufacturing results in a lower level of work-in-progress inventories in comparison to job shop because the production management tasks

are less complex in this manufacturing. Thus it permits increased control of excess inventory. Also, it involves quickest set ups and fewer tooling changes.

7. (a)

Belt conveyor is used for handling of limestone during cement manufacturing.

8. (c)

In product layout, specific operation are performed at various work stations for which special purpose machine along with semi-skilled labour is required.

9. (d)

A learning curve is a graphical representation between increase of learning and experience i.e. the level of achievement with reference to time.

10. (b)

In order to balance low demand high capacity situation, diversification is used.

11. (c)

Product layout - Mass production
Process layout - Batch production
Fixed position layout - Huge job such as air crafts, ships, etc.

Quality Analysis & Control and Work study

- Q.1** The basic objective of quality control in any organization is to
- Integrate quality development, quality maintenance and quality improvement activities in the organization
 - achieve optimum costs
 - achieve customers satisfaction
 - achieve all the above
- Q.2** The cost associated with the defective products produced are called
- Cost of internal failure
 - Cost of external failure
 - Cost of prevention
 - Cost of appraisal
- Q.3** In normal distribution
- $\bar{X} = X'$; $\sqrt{\bar{X}} = \sigma'$
 - $\bar{X} = X'$; $\sqrt{\bar{X}} = \frac{\sigma'}{\sqrt{n}}$
 - $\bar{X} = X'$; $\sqrt{\bar{X}} = \sigma' \times \sqrt{n}$
 - $\bar{X} = \frac{X'}{\sqrt{n}}$; $\sqrt{\bar{X}} = \sigma'$
- \bar{X} - mean of sample
 X' - mean of universe
 $n \rightarrow$ sample size
 $\sqrt{\bar{X}}$ \rightarrow standard deviation of sample
 σ' \rightarrow standard deviation of universe
- Q.4** The factors A_1, A_2, D_1, D_2, D_3 etc. to calculate control limit depend upon
- the universe
 - extent of control required
 - process capability
 - sample size
- Q.5** Mathematically process capability is equal to
- $\frac{\sigma'}{\sqrt{n}}$
 - $3\sigma'$
 - $6\sigma'$
 - $\bar{X} + 3\sigma$
- where (σ' = standard deviation)
- Q.6** Which of the following can be considered the advantage of attribute chart over variable chart?
- provides the detailed information for control of individual characteristic
 - recognizes the degree of defectiveness
 - easily computable and understood by all persons
 - None of these
- Q.7** Match **List-I** with **List-II** and choose the correct answer using the codes given below the lists:
- | List-I | List-II |
|------------------------------------|--|
| A. Cost of prevention | 1. Cost of quality audit |
| B. Cost of appraisal | 2. cost of quality planning |
| C. Cost of internal failure | 3. Cost of rework & repair |
| D. Cost of external failure | 4. Cost of maintaining quality level |
| | 5. Cost of processing complaints from the customers |
- Codes:**
- | | A | B | C | D |
|-----|----------|----------|----------|----------|
| (a) | 1 | 3 | 2 | 4 |
| (b) | 2 | 1 | 3 | 5 |
| (c) | 2 | 1 | 3 | 4 |
| (d) | 4 | 1 | 3 | 5 |
- Q.8** Consider the following statements
- cost of prevention is low with low quality product
 - cost of failure is low with low quality product
 - cost of failure is low with high quality product
 - cost of prevention is high with high quality product

- Q.14** In a double sampling plan, $N = 500$, $n_1 = 10$, $n_2 = 8$, $C_1 = 2$ and $C_2 = 4$. If the number of defectives in the first sample are 3, then the decision will be
 (a) Reject the lot
 (b) Accept the lot
 (c) Take the second sample and inspect
 (d) None of these
- Q.15** A process is to be controlled with standard values $\mu = 15$ and $\sigma = 3.6$. The sample size is 9. The control limit for the \bar{X} chart are
 (a) 15 ± 10.8 (b) 15 ± 3.6
 (c) 0.4 ± 10.8 (d) 0.4 ± 3.6
- Q.16** The observed time for a particular observation is 1 min. If the rating factor for that particular operators is 85% and an allowance of 20% is to be given, the standard time is
 (a) 1 min (b) 0.85 min
 (c) 1.02 min (d) 1.05 min
- Q.17** A 100 percent premium plan for incentive payment is in operation. An operation has a standard time of 0.40 minutes per piece. A worker works on the job and produces 1500 pieces. If the base rate is ₹ 5 per hour. His earning for the day in ₹ is
 (a) 50 (b) 60
 (c) 60 (d) 55
- Q.18** During an 8 hour study a worker was found to be idle for 18% of time and produced 1800 units. If 15% allowance is to be provided. The standard time is
 (a) 13.12 sec (b) 15.088 sec
 (c) 14.2 sec (d) 14.67 sec
- Q.19** The management is interested to know the percentage of idle time of an equipment. The trial study showed that it would be 20%. The number of random observation necessary for 95% level of confidence, ($Z = 2$) and 5% accuracy is _____.
- Q.20** In a 'C' chart the value of C' is 49. The upper control limit of the chart is equal to _____.
- Q.21** The distance between the upper and lower control limits in \bar{X} -chart is 0.25 mm, when the process is under control and sample size is 4. The process capability (in mm) is equal to _____.
- Q.22** 7, 7, 7, 6, 6, 9, 8 and 6 are the times recorded for one element of operation. The number of cycles that are necessary for the study if the error is not to exceed 5% at the confidence level of 99.7% is _____.
- Q.23** If the probability of acceptance of a 3% defective lot is 0.97, then AOQ is _____.
- Q.24** The following data is available from time study on a job, Observed time = 0.75 min, rating = 110%, relocation allowance = 10%, personal allowance = 3%, delay allowance = 2%. All allowances are expressed in % of normal time. The approximate standard time (in min) for this job is _____.
- Q.25** Standard Time (ST) and labour rates are as in the table. Labour overheads are 20% of labour cost.

Activity	ST. Min	Labout rate ₹/hr
Cutting	2	550
Inspection	0.5	400
Packaging	0.5	400

If the material cost is ₹ 25 unit, the total cost of production in ₹/unit will be _____.

- Q.26** The workmen in an engineering company are expected to work for 400 minutes in a shift of 8 hours. The remaining time is meant for rest and personal needs etc. The normal time per piece is 2 minutes. The standard time per piece (in min.) will be _____.



Answers Quality Analysis & Control and Work study

1. (d) 2. (a) 3. (b) 4. (d) 5. (c) 6. (c) 7. (d) 8. (c) 9. (a)
 10. (d) 11. (d) 12. (d) 13. (c) 14. (c) 15. (b) 16. (c) 17. (a) 18. (b)
 19. (6400) 20. (70) 21. (0.5) 22. (72) 23. (0.0291) 24. (0.949) 25. (55) 26. (2.4)

$$\begin{aligned}\Sigma fx &= 56 \\ \Sigma fx^2 &= 400 \\ Z &= 3 \\ s &= 0.05\end{aligned}$$

$$\therefore N = \left[\frac{Z \sqrt{n \Sigma fx^2 - (\Sigma fx)^2}}{s \Sigma fx} \right] = 72$$

23. (0.0291)

$$AOQ = \frac{3}{100} \times 0.97 = 0.0291$$

24. (0.949)

$$\begin{aligned}\therefore \quad OT &= 0.75 \text{ min} \\ NT &= OT \times RF = 0.75 \times 1.1 \\ &= 0.825 \text{ min} \\ ST &= NT + \text{Allowance} \\ &= 0.825 + (0.1 + 0.03 + 0.02) \times 0.825 \\ &= 0.94875 \text{ min} \\ &= 0.949 \text{ min}\end{aligned}$$

25. (55)

Total production cost = Material cost + Labour cost

$$\begin{aligned}&= 25 + 1.2 \times \left[\frac{550}{60} \times 2 + \frac{400}{60} \right] \\ &\quad \times 0.5 + \frac{400}{60} \times 0.5 \\ &= 25 + 30 = ₹ 55\end{aligned}$$

26. (2.4)

$$\text{Total allowance} = 8 \times 60 - 400 = 80 \text{ min}$$

$$\text{No. of pieces per shift} = \frac{400}{2} = 200$$

$$\text{Allowance per piece} = \frac{80}{200} = 0.4 \text{ min}$$

$$\begin{aligned}\therefore \quad ST &= NT + \text{Allowance} \\ &= 2 + 0.4 = 2.4 \text{ min}\end{aligned}$$

