INDEX

ESE – GENERAL STUDIES & ENGINEERING APTITUDE

1 Current Issues of National & International Importance

1.1 Economic Developments and Trends..... 1
1.2 Environment and Biodiversity. 10
1.3 National News and Governance..... 11
1.4 Global Affairs and Geopolitics..... 19
1.5 Defence and Security Affairs 23
1.6 Science, Innovation, and Technology..... 24
1.7 General Current Issues 26

2 Engineering Aptitude

2.1 Analytical Aptitude 31
2.2 Quantitative Aptitude 44

3 Engineering Mathematics & Numerical Analysis

3.1 Calculus..... 67
3.2 Linear algebra..... 77
3.3 Complex analysis 82
3.4 Ordinary Differential Equations 85
3.5 Partial Differential Equations 87
3.6 Numerical Methods..... 88
3.7 Fourier Series and Fourier Transform 91
3.8 Laplace Transform and Z-Transform 95
3.9 Probability and Statistics..... 97

4 General Principles of Design, Drawing, Importance of Safety

4.1 Engineering Design and Process..... 102
4.2 Scales and Technical Drawing Basics..... 106
4.3 Projection and Visualization..... 108
4.4 Surface Development and CAD 113
4.5 Industrial Safety Fundamentals..... 115
4.6 Mechanical Applications and Calculations..... 121

5 Standards & Quality Practices in Production, Construction, Maintenance & Services

5.1 Foundations of Quality and Management Systems..... 125
5.2 Statistical Tools and Sampling Techniques..... 130
5.3 Total Quality Management and Six Sigma..... 136
5.4 Quality in Manufacturing, Construction, and Services 139
5.5 Reliability, Maintenance, and Resource Management..... 143
5.6 Inventory and Supply Chain Practices.... 145

6 Basics of Energy and Environment

6.1 Energy Resources and Conservation 148
6.2 Environment, Ecology, and Biodiversity. 154
6.3 Pollution, Degradation, and Climate Change 157
6.4 Environmental Assessment and Sustainable Development..... 166
6.5 Disaster Management and Mitigation.... 169

7 Basics of Project Management

7.1 Project Fundamentals and Life Cycle..... 173
7.2 Project Initiation and Appraisal 178
7.3 Financial Planning and Analysis 180
7.4 Project Planning, Scheduling, and Control 184
7.5 Tendering and Contract Management ... 191

8 Basics of Material Science & Engineering

8.1 Chemical Bonding..... **194**
8.2 Crystallography..... **197**
8.3 Electric Properties of Materials..... **200**
8.4 Magnetic Properties of Materials **203**
8.5 Mechanical Properties of Materials..... **204**
8.6 Ceramics..... **209**
8.7 Polymers..... **211**
8.8 Composites..... **214**
8.9 Ferrous Metals, Non-ferrous Metals & Alloys..... **215**
8.10 Corrosion, Creep, & Heat Treatment of Materials..... **220**

9 Information & Communication Technologies (ICT) Based Tools & Their Applications in Engineering

9.1 Introduction to ICT and Tools..... **223**
9.2 Communication and Networking **226**
9.3 ICT in Governance and Education **238**
9.4 Emerging Trends in ICT..... **245**

10 Ethics and Values in Engineering Profession

10.1 Foundations of Ethics and Values **248**
10.2 Ethical Theories and Professional Values **253**
10.3 Ethical Challenges and Misconduct in Engineering..... **261**
10.4 Responsibilities and Codes of Conduct for Engineers **265**

ESE PAPER -1 GENERAL STUDIES & ENGINEERING APTITUDE NUMBER OF QUESTIONS ASKED IN PREVIOUS EXAMS (2017-2025)										
CURRENT ISSUES OF NATIONAL & INTERNATIONAL IMPORTANCE		2017	2018	2019	2020	2021	2022	2023	2024	2025
1.1	Economic Developments and Trends	3	2	9	7	1	1	2	1	6
1.2	Environment and Biodiversity	-	-	-	-	2	1	-	-	-
1.3	National News and Governance	3	4	-	-	7	4	4	6	3
1.4	Global Affairs and Geopolitics	-	1	-	1	-	3	4	2	1
1.5	Defence and Security Affairs	-	-	-	-	-	2	4	-	-
1.6	Science, Innovation, and Technology	-	-	-	-	2	3	-	2	-
1.7	General Current Issues	1	1	-	-	5	1	5	-	-

CHAPTER-1

CURRENT ISSUES OF NATIONAL & INTERNATIONAL IMPORTANCE

Unit 1.1: Economic Developments and Trends

Previous Year Exam Questions

[ESE 2017 PAPER - 1]

1. Which of the following methods are considered as most favourable to production organizations liable for Taxation?

1. Straight line method of depreciation
2. Declining balance method of depreciation
3. Sum of the years digits method of depreciation
4. Sinking fund method of depreciation

Select the correct answer using the codes given below:

(a) 1 and 2 (b) 2 and 3
(c) 3 and 4 (d) 4 and 1

[ESE 2017 PAPER - 1]

2. Consider the following statements regarding Repo rate:

1. It is the rate at which RBI lends money to Commercial Banks generally against Government Securities
2. It is the rate at which RBI borrows money from Commercial Banks generally against Government Securities
3. It is the rate at which Commercial Banks keep Deposits with RBI

Which of the above statements is/are correct?

(a) 1 only (b) 2 only
(c) 3 only (d) 1, 2 and 3

[ESE 2017 PAPER - 1]

3. Consider the following statements regarding GST:

1. The GST Bill 2014 has the purpose to improve the Value Added Tax on Goods and Services
2. It can be imposed differently in different States
3. It is a Comprehensive Tax imposed nationwide irrespective of any State concerned
4. It is a significant step in the reform of Indirect Taxation in India

Which of the above statements are correct?

(a) 1, 2 and 3 (b) 1, 2 and 4
(c) 2, 3 and 4 (d) 1, 3 and 4

[ESE 2018 PAPER - 1]

4. Consider the following statements:

Non-performing assets (NPAs) decline in value when

1. Demand revives in the economy.
2. Capacity utilization increases.
3. Capacity utilization, though
4. substantive, is yet sub-optimal Capacity utilization. Decreases consequent upon merger of units.

Which of the above statements are correct?

(a) 1, 3 and 4 only (b) 1, 2 and 4 only
(c) 1, 2 and 3 only (d) 1, 2, 3 and 4

[ESE 2018 PAPER - 1]

5. What is Crowdfunding?

(a) Money collected for public welfare projects by levying an entry fee to exhibitions, shows, etc.
(b) Money collected by charitable organizations by placing a donation box at prominent locations
(c) Money raised by innovators and inventors by launching their products and services through the Internet
(d) Money raised by individuals by passing the hat around to onlookers at a street performance

[ESE 2019 PAPER - 1]

6. Which one of the following is not a component of 'Capital Receipts"?

(a) Market borrowings including special bonds
(b) External loans raised by the Central Government from abroad
(c) Receipts from taxes on property and capital transactions
(d) Provident Funds (State Provident Funds and Public Provident Fund)

[ESE 2019 PAPER - 1]

7. Which one of the following statement is correct with respect to the 'societal development?

(a) Behaviour grows into habits, habits into tradition and tradition becomes custom
(b) Customs grow into mores and mores grow into custom
(c) Behaviours grow into customs and customs grow into traditions
(d) Folkways grow into tradition and traditions grow into customs

[ESE 2019 PAPER - 1]

8. Which one of the following statements is correct with respect to 'the convergence theory' on social change?

(a) The societal adaptive culture is changing more slowly
(b) As societies become modernized, they begin to resemble one another more closely
(c) The developed countries show more growth in social changes than the less developed countries
(d) Strong opposition by old people retards the social change

[ESE 2019 PAPER - 1]

9. With respect to the conduct and performance of a company, 'perfect competition" refers to
(a) Large number of small firms producing differentiated products
(b) Complete freedom in economic life and absence of rivalry among firms
(c) Many companies selling similar products with free entry
(d) Sole producer selling a distinct product

[ESE 2019 PAPER - 1]

10. The cheapest method of marketing of securities with the only cost incurred being on sending 'letters of rights' to existing holders is
(a) Public issue through prospectus method
(b) Offer for sale method
(c) Rights issue
(d) Subscription by inside coterie method

[ESE 2019 PAPER - 1]

11. 'Fiscal policy" means
(a) Balancing the revenue collection and expenditure
(b) Establishing equilibrium between demand and supply of goods and services
(c) Use of taxation, public borrowing and public expenditure by Government for purposes of 'stabilization" or 'development'
(d) Deficiency as an instrument of growth

[ESE 2019 PAPER - 1]

12. Which of the following come under the offerings of 'MUDRA' Bank?
1. Portfolio Credit Guarantee
2. Credit for large industries
3. MUDRA Card
4. Credit Enhancement

Select the correct answer using the codes given below:
(a) 1, 2 and 3.only (b) 1, 3 and 4 only
(c) 1, 2 and 4 only (d) 2, 3 and 4 only

[ESE 2019 PAPER - 1]

13. Which of the following is/are the key Reasons for encouraging start up Entrepreneurship?
1. Innovations
2. Focusing on service industry
3. Bringing the values of proactivity into the society

Select the correct answer using the codes given below:
(a) 1 only (b) 2 only
(c) 1 and 3 only (d) 1, 2 and 3

[ESE 2019 PAPER - 1]

14. Which of the following are the main objectives of Gold Monetization Scheme launched in the country?
1. To monetize gold holdings in the country
2. To increase export of gold from the country
3. To reduce India's import bill
4. To meet the targets of reduction in fiscal deficit

Select the correct answer using the codes given below:
(a) 1 and 4 only (b) 2 and 4 only
(c) 2 and 3 only (d) 1 and 3 only

[ESE 2020 PAPER - 1]

15. What is TADF?
(a) Technology Acquired Desired Firm
(b) Technologically Advanced Direct Fund
(c) Technologically Accomplished Direct Fund
(d) Technology Acquisition and Development Fund

[ESE 2020 PAPER - 1]

16. Which one of the following is a measure of sustainable income level that can be secured without decreasing the stock of natural assets?
(a) Natural Capital Stock
(b) Environmental Value
(c) Green Accounting
(d) Social Discount Rate

[ESE 2020 PAPER - 1]

17. Which one of the following is a resource allocation as per Chenery's development process?
(a) Investment
(b) Structure of domestic demand
(c) Labour allocation
(d) Government revenue

[ESE 2020 PAPER - 1]

18. Which one of the following ratios is referred to as everything that has been invested in the past and to the whole income?
(a) Capital-output ratio
(b) Average capital-output ratio
(c) Incremental capital-output ratio
(d) Marginal ratio

[ESE 2020 PAPER - 1]

19. Which one of the following methods of planning is an attempt to work out the implications of the

development effort in terms of factor allocations and product yields so as to maximize income and employment?

(a) Perspective planning
(b) Physical planning
(c) Financial planning
(d) Indicative planning

[ESE 2020 PAPER - 1]

20. Which one of the following reflects an intrinsic or true value for factors or products?

(a) Price inflation
(b) Economy pricing
(c) Penetration pricing
(d) Shadow price

[ESE 2020 PAPER - 1]

21. Which one of the following control policies leaves no freedom to private enterprise to buy plant, machinery, raw materials from the country of its choice?

(a) Import control (b) Export control
(c) Exchange control (d) Physical control

[ESE 2021 PAPER - 1]

22. Statement (I): Issue of shares is the most common method especially to raise long- term funds.
Statement (II): The equity shareholders are residual owners who have restricted claim on income as dividend.

(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
(b) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)
(c) Statement (I) is true but Statement (II) is false
(d) Statement (I) is false but Statement (II) is true

[ESE 2022 PAPER - 1]

23. Which one of the following statements is NOT correct regarding the Pension Fund Regulatory and Development Authority (PFRDA)?

(a) It has increased the entry age for the National Pension System (NPS) from 60 years to 65 years
(b) Earlier the eligible age to invest in NPS was 18-65 years which has now been revised to 18-70 years
(c) As per the revised norms, any Indian Citizen, resident or non- resident and Overseas Citizen of India (OCI) between the age of 65-70 years can join NPS
(d) Subscribers can continue or defer their NPS Account up to the age of 75 years

[ESE 2023 PAPER - 1]

24. Consider the following economic activities:

1. Public administration
2. Financial services
3. Mining and quarrying

Which of the above economic activities fall under the tertiary sector?

(a) 1 and 3 only (b) 1, 2 and 3
(c) 2 and 3 only (d) 1 and 2 only

[ESE 2023 PAPER - 1]

25. IMF raises its projection for economic growth in 2021-22 to

(a) 11.3% (b) 12.5%
(c) 10.2% (d) 8.4%

[ESE 2024 PAPER - 1]

26. Consider the following statements:

1. India's Goods and Services Tax collection for the month of June 2023 reached 1-61 trillion, according to the Ministry of Finance.
2. India received its highest-ever FDI inflow of US$83-57 billion in the fiscal year 2021-2022.
3. The net direct tax collection in the current fiscal year has witnessed a significant growth of 16%, reaching 4-75 lakh crore, indicating a surge in economic activity.

Which of the above statements are correct?

(a) 1 and 2 only
(b) 1 and 3 only
(c) 2 and 3 only
(d) 1, 2 and 3

[ESE 2025 PAPER - 1]

27. An Income Elasticity of Demand e_i is

(a) $\frac{Q_2-Q_1}{I_2-I_1} \times \frac{I_2+I_1}{Q_2+Q_1}$ (b) $\frac{Q_2+Q_1}{I_2-I_1} \times \frac{I_2+I_1}{Q_2+Q_1}$
(c) $\frac{Q_2-Q_1}{I_2+I_1} \times \frac{I_2-I_1}{Q_2+Q_1}$ (d) $\frac{Q_2-Q_1}{I_2+I_1} \times \frac{I_2+I_1}{Q_2+Q_1}$

where:
Q_1 is quantity demanded in the base year
Q_2 is quantity demanded in the following year
I_1 is income level in the base year I_2 is income level in the following year

[ESE 2025 PAPER - 1]

28. Statement (I): A country which doubles its capital in ten years will have a higher output per unit of capital than a country which doubles it in twenty years.
Statement (II): New investment and new technology go together.

(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)

(b) Both Statement (I) and Statement (II) are individually true but Statement (II) is NOT the correct explanation of Statement (I)
(c) Statement (I) is true but Statement (II) is false
(d) Statement (I) is false but Statement (II) is true

[ESE 2025 PAPER - 1]

29. Which one of the following branches of economics is focusing on improving fiscal, economic and social conditions in developing (low income) countries?
(a) Social economics (b) Fiscal economics
(c) Development economics (d) Micro economics

[ESE 2025 PAPER - 1]

30. Which one of the following is an effort to get to the next stage of creating a pan-India electronic portal, which networks the existing APMC mandis by creating a national market for agricultural commodities?
(a) National APMC Market
(b) National Agricultural Market
(c) National Network Portal
(d) National Electronic Portal

[ESE 2025 PAPER - 1]

31. Government's strategy in respect of public expenditure and revenue can have significant impact on the business is called
(a) Monetary policy (b) Fiscal policy
(c) Trade policy (d) Industrial policy

[ESE 2025 PAPER - 1]

32. Which of the following arguments advanced in favour of labour-intensive techniques?
1. In underdeveloped countries there is an acute shortage of capital and entrepreneurial resources
2. There is considerable saving in foreign exchange
3. These techniques quickly increase the supply of consumable goods and obviate the danger of inflation
4. More employment will be offered to the labour force in the long run

(a) 1, 2 and 4 only (b) 1, 3 and 4 only
(c) 1, 2 and 3 only (d) 2,3 and 4 only

ANSWER KEY									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
(b)	(a)	(d)	(c)	(c)	(c)	(a)	(b)	(c)	(c)
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
(c)	(b)	(c)	(d)	(d)	(c)	(b)	(b)	(b)	(d)
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
(a)	(a)	(a)	(d)	(b)	(d)	(a)	(a)	(c)	(b)
31	**32**								
(b)	(a)								

EXPLANATIONS

1. Explanation: (b)
Analysis of Each Method:
1. Straight Line Method:
- Depreciation is uniform every year.
- Not favorable for tax savings in early years.
2. Declining Balance Method:
- Accelerated depreciation: higher in early years, less later.
- Favoured for taxation purposes (tax deferral benefit).
3. Sum of the Years' Digits (SYD):
- Also an accelerated depreciation method.
- Higher depreciation in earlier years.
- Favoured for taxation.
4. Sinking Fund Method:
- Provides lower depreciation initially, increasing over time.
- Not favourable for tax saving in early years.

The most favourable for tax purposes are:
- 2. Declining Balance Method
- 3. Sum of the Years' Digits Method

2. Explanation: (a)
Statement 1: Correct
This is the definition of the Repo Rate.
"Repo" = Repurchase Agreement: Banks borrow from RBI and give government securities as collateral.
Statement 2: Incorrect
This describes the Reverse Repo Rate, not the Repo Rate.
Under Reverse Repo, RBI borrows from banks, and pays interest (reverse of Repo).
Statement 3: Incorrect
This is not Repo Rate.
Banks do keep reserves with RBI (like CRR), but that's not connected to Repo Rate.
Correct Answer: (a) 1 only

3. Explanation: (d)
Statement 1: Correct
While GST replaces VAT and other indirect taxes, it builds on the value-added tax principle, making taxation more uniform and efficient.
Statement 2: Incorrect
GST is a uniform tax system applied across India.
Though both the Centre (CGST) and States (SGST) levy GST, rates are decided by the GST Council, and cannot be varied independently by individual states.

Statement 3: Correct
GST is a destination-based, comprehensive, and nationwide indirect tax.
It applies uniformly across all states.
Statement 4: Correct
GST is widely regarded as one of the biggest indirect tax reforms since independence.

4. Explanation: (c)

Non-Performing Assets (NPAs) are loans or advances that are in default or in arrears. They typically decline (i.e., improve) when the financial health of borrowers improves — which happens under the following conditions:

1. **Demand revives in the economy – Correct**
   A rise in demand leads to increased sales and revenue for businesses, improving their ability to repay loans.
2. **Capacity utilization increases – Correct**
   Higher capacity utilization means businesses are using more of their productive capacity, indicating higher output and potentially better profitability — aiding loan repayment.
3. **Capacity utilization, though substantive, is yet sub-optimal – Correct**
   Even if not optimal, substantive capacity utilization is still better than low or idle capacity. It signals partial recovery, which can still lead to improvement in loan repayment and hence a reduction in NPAs.
4. **Capacity utilization decreases consequent upon merger of units –Incorrect**
   A decrease in capacity utilization implies reduced production efficiency and possibly lower revenues, which may increase the risk of default, not reduce NPAs.

Correct answer: (c) 1, 2 and 3 only

5. Explanation: (c)

Crowdfunding is a method of raising small amounts of money from a large number of people, typically via the Internet, to fund a project, product, startup, or cause. It is commonly used by:

- Entrepreneurs to launch new products or startups
- Artists to fund creative projects
- Nonprofits to support charitable causes

Popular platforms include Kickstarter, Indiegogo, and GoFundMe.
Correct Answer: (c)

6. Explanation: (c)

These are **receipts that either create a liability or reduce an asset**. Common examples include:

- Market borrowings
- Loans from external sources
- Recoveries of loans
- Small savings, Provident Funds, etc.

(a) Market borrowings including special bonds
These are borrowings that **create liabilities** — clearly **Capital Receipts**.

(b) External loans raised by the Central Government from abroad
These also **create liabilities** — another clear **Capital Receipt**.

(c) Receipts from taxes on property and capital transactions
Taxes are part of **Revenue Receipts**, not Capital Receipts.
They **do not create liabilities or reduce assets** — they are non-repayable.

(d) Provident Funds (State Provident Funds and Public Provident Fund)
These are **liabilities** for the government (they are eventually repayable), so they are **Capital Receipts**.
Correct Answer: (c) Receipts from taxes on property and capital transactions

7. Explanation: (a)

(a) Behaviour grows into habits, habits into tradition and tradition becomes custom
This sequence correctly represents a gradual social development:

- Behaviour → personal action
- Repeated becomes habit
- Widespread habits become traditions
- Traditions, when formalized socially, become customs

(b) Customs grow into mores and mores grow into custom
Incorrect progression; mores are more morally significant than customs, and customs don't grow into mores.

(c) Behaviours grow into customs and customs grow into traditions
Incorrect order; traditions typically emerge before customs, not after.

(d) Folkways grow into tradition and traditions grow into customs

Folkways and customs are parallel informal norms; this sequence is not accurate.

Correct Answer: (a) Behaviour grows into habits, habits into tradition and tradition becomes custom

8. Explanation: (b)

Convergence Theory suggests that **as societies modernize**, especially through **industrialization, urbanization, and technological advancement**, their **social, economic, and cultural systems begin to resemble one another**, regardless of their historical or cultural starting points.

(a) The societal adaptive culture is changing more slowly

This describes the **cultural lag theory**, not convergence theory.

(b) As societies become modernized, they begin to resemble one another more closely

This is the **core idea** of **Convergence Theory** — modernization leads to similarities in social structure, institutions, and values.

(c) The developed countries show more growth in social changes than the less developed countries

Not specific to convergence theory; also oversimplifies social dynamics.

(d) Strong opposition by old people retards the social change

This relates more to **resistance to change**, not to convergence theory.

Correct Answer: (b) As societies become modernized, they begin to resemble one another more closely

9. Explanation: (c)

(a) Large number of small firms producing differentiated products

Incorrect — differentiation implies **monopolistic competition**, **not perfect competition**.

(b) Complete freedom in economic life and absence of rivalry among firms

Incorrect — While there's freedom of entry/exit, **rivalry exists** via price competition. Also, this is too vague and idealistic.

(c) Many companies selling similar products with free entry

Correct — This best describes **perfect competition**:

- "Many companies" = large number of firms
- "Similar products" = homogeneous products
- "Free entry" = no barriers to entry or exit

(d) Sole producer selling a distinct product

Incorrect — This is the definition of a **monopoly**, not perfect competition.

Correct Answer: (c) Many companies selling similar products with free entry

10. Explanation: (c)

The question asks for the **cheapest method of marketing securities**, where the **only cost incurred is sending 'letters of rights' to existing shareholders**.

(a) Public issue through prospectus method

Expensive method involving printing of prospectus, advertising, underwriting, regulatory compliance, etc.

(b) Offer for sale method

Involves an intermediary (often a merchant banker or broker), and is **costlier** due to underwriting, listing fees, etc.

(c) Rights issue

This is where **existing shareholders** are given the right to purchase additional shares **at a discounted price**.

It is **inexpensive**, as no major promotional activities are needed.

Main cost: Sending **letters of rights** (notification) to existing shareholders.

Correct – the cheapest method

(d) Subscription by inside coterie method

Involves select insiders (promoters, directors), but **not necessarily the cheapest** or most transparent method.

Correct Answer: (c) Rights issue

11. Explanation: (c)

The use of government revenue and expenditure tools — primarily taxation, public borrowing, and public spending — to influence a country's economic activity. Its main goals include:

- Economic stabilization
- Economic development
- Redistribution of income
- Control of inflation or deflation

(a) Balancing the revenue collection and expenditure

This describes a balanced budget, not the full scope of fiscal policy.

(b) Establishing equilibrium between demand and supply of goods and services

This is more aligned with market equilibrium theory, and relates more to monetary policy and price mechanism.

CHAPTER-5

STANDARDS AND QUALITY PRACTICES IN PRODUCTION, CONSTRUCTION, MAINTENANCE AND SERVICES

Unit 5.1: Foundations of Quality and Management Systems

Previous Year Exam Questions

[ESE 2017 PAPER – 1]

1. **Statement (I): Quality Circle is method to bring Organizational Improvement through indulging the workers.**
   Statement (II): The main aim of Quality Circle is self-development and mutual development of grass root level employees.
   (a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
   (b) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
   (c) Statement (I) is true but Statement (II) is false
   (d) Statement (I) is false but Statement (II) is true

[ESE 2017 PAPER – 1]

2. **Concurrent engineering is implemented by involving a cross-functional team for design, production, testing and operational work**
   (a) During the project execution
   (b) Long before the project execution
   (c) Towards the end of the project execution
   (d) After completion of the project execution

[ESE 2017 PAPER – 1]

3. **For which of the following sectors do comprehensive safety and health statutes, for regulating Occupational Safety and Health (OSH) at work places, exist at present in India?**
   (a) Mining, Factories, Ports and Agriculture
   (b) Factories, Mining, Agriculture and Construction
   (c) Mining, Factories, Ports and Construction
   (d) Factories, Ports, Agriculture and Construction

[ESE 2017 PAPER – 1]

4. **Internal audits are used to verify whether:**
   1. Products conform to technical specifications
   2. Quality management systems are effectively implemented
   Which of the above statements is/are correct?
   (a) 1 only (b) 2 only
   (c) Both 1 and 2 (d) Neither 1 nor 2

[ESE 2018 PAPER – 1]

5. **Consider the following statements regarding Quality Circle:**
   1. It is a small group of people working in different areas of an organization with multiple expertises.
   2. It consists of people who volunteer themselves.
   3. It is a human resource development technique.
   4. It is a problem-solving forum.
   Which of the above statements are correct?
   (a) 2, 3 and 4 only (b) 1, 2 and 3 only
   (c) 1, 3 and 4 only (d) 1, 2 and 4 only

[ESE 2018 PAPER – 1]

6. **Statement (I):** The concept of Just-In-Time is operationalized when the exact number of units required are bought at each successive stage of production, at the appropriate time.
   Statement (II): Just-In-Time concept has been expanded to mean. a manufacturing philosophy of eliminating waste.
   (a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
   (b) Both Statement (I) and Statement (II) are individually true, but Statement (II) is not the correct explanation of Statement (I))
   (c) Statement (I) is true, but Statement (II) is false
   (d) Statement (I) is false, but Statement (II) is true

[ESE 2018 PAPER – 1]

7. **Statement (I):** Quality is essential for survival and growth of an organisation in the procont era of tough competition.
   Statement (II): The concept of quality is confined only to construction and manufacturing organisations.
   (a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
   (b) Both Statement (I) and Statement (II) are individually true, but Statement (II) is not the correct explanation of Statement (I))
   (c) Statement (I) is true, but Statement (II) is false
   (d) Statement (I) is false, but Statement (II) is true

[ESE 2019 PAPER – 1]

8. Statement (I): The prevention costs increase with the introduction of a quality system and may be a significant proportion of the total quality costs.
Statement (II): Costs associated with education and training are not included in prevention costs.
(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
(b) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
(c) Statement (I) is true but Statement (II) is false
(d) Statement (I) is false but Statement (II) is true

[ESE 2019 PAPER – 1]

9. Which of the following approaches are correct regarding total quality?
1. Opportunity to improve
2. Adoption requires little change
3. React to competitive threats

Select the correct answer using the codes given below:
(a) 1 and 2 only (b) 1 and 3 only
(c) 2 and 3 only (d) 1, 2 and 3

[ESE 2019 PAPER – 1]

10. Consider the following components:
1. Knowledge of psychology
2. Knowledge of the theory of variation
3. Knowledge of process
4. Knowledge of the system and the theory of optimization

Which of the above components comprise the basis of Deming's Systems of Profound Knowledge?
(a) 1, 2 and 3 only (b) 1, 3 and 4 only
(c) 1, 2 and 4 only (d) 2, 3 and 4 only

[ESE 2020 PAPER – 1]

11. Which one of the following is not the best approach for the prevention of product liability?
(a) Analysis and design (b) Quality control
(c) Comprehensive testing (d) Cost

[ESE 2020 PAPER – 1]

12. Which of the following steps come under 14-step plan for quality improvement?
1. Ad hoc committee for the zero defects program
2. Cost of quality evaluation
3. Quantity measurements
4. Supervisor training
(a) 1, 2 and 3 (b) 1, 2 and 4
(c) 1, 3 and 4 (d) 2, 3 and 4

[ESE 2021 PAPER – 1]

13. Most of Deming's deadly diseases involve
(a) immobility of management
(b) a long term orientation
(c) a lack of understanding of variation
(d) high degree of constancy of purpose

[ESE 2022 PAPER – 1]

14. Consider the following statements with reference to principal quality objectives:
1. The organization should achieve and sustain the quantity of the product so as to continually meet the purchaser's stated or implied needs.
2. The organization should provide confidence to its own management that the intended quality is being achieved and sustained.
3. The organization should provide confidence to the purchaser that the intended quality is being, or will be, achieved in the delivered product.

Which of the above statements are correct?
(a) 1 and 2 only (b) 2 and 3 only
(c) 1 and 3 only (d) 1, 2 and 3

[ESE 2022 PAPER – 1]

15. The quality characteristics can be categorized in which of the following groupings?
1. Sensory characteristics
2. Structural characteristics
3. Statistical characteristics
4. Time oriented characteristics

Select the correct answer using the code given below:
(a) 1, 2, 3 and 4 (b) 1 and 4 only
(c) 2 and 3 only (d) 1, 2 and 4 only

[ESE 2022 PAPER – 1]

16. What are the major categories for quality costs?
1. Prevention costs
2. Appraisal costs
3. Production costs
4. Internal failure costs

Select the correct answer using the code given below:
(a) 1, 2 and 3 only (b) 1, 2 and 4 only
(c) 3 and 4 only (d) 1, 2, 3 and 4

[ESE 2022 PAPER – 1]

17. Consider the following statements regarding production:
The major aspects of production that may lead to sickness are
1. increase in the cost of production.
2. decrease in the quantity of production.

3. quality of product not meeting the standards/customer expectation.
4. Producing more quantity than can be sold, leading to accumulation of stock.

Which of the above statements are correct?

(a) 1 and 2 only (b) 1, 2, 3 and 4
(c) 2 and 3 only (d) 1, 3 and 4 only

[ESE 2023 PAPER – 1]

18. Statement (I): The machine shop produces parts machined from stock material and finishes castings, forgings, etc., requiring machined surfaces.

Statement (II): In machine shops, machining operations remove metal, either to make a smoother and more accurate surface, as by planning, facing, milling, etc. or to produce a surface previously existing, as by drilling, punching, etc.

(a) Both Statement (I) and Statement (II) are individually true and Statement (II) is the correct explanation of Statement (I)
(b) Both Statement (I) and Statement (II) are individually true but Statement (II) is not the correct explanation of Statement (I)
(c) Statement (I) is true but Statement (II) is false
(d) Statement (I) is false but Statement (II) is true

ANSWER KEY									
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
(b)	(b)	(c)	(c)	(a)	(b)	(c)	(c)	(b)	(c)
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**		
(d)	(b)	(c)	(b)	(d)	(b)	(b)	(a)		

EXPLANATIONS

1. Explanation: (b)

Statement (I): "Quality Circle is method to bring Organizational Improvement through indulging the workers."

- This is true.
- Quality Circles are small groups of workers who voluntarily meet regularly to identify, analyze, and solve work-related problems, improving organizational performance.

Statement (II): "The main aim of Quality Circle is self-development and mutual development of grass root level employees."

- This is also true.
- Quality Circles promote personal growth, teamwork, and employee participation.
- The main purpose of Quality Circles is **organizational improvement** through worker participation (Statement I).
- While self and mutual development (Statement II) are benefits or secondary aims, they do **not fully explain** the primary goal of organizational improvement.

Summary:

- Both statements are true, but Statement (II) does **not** correctly explain Statement (I).

Final answer: (b)

2. Explanation: (b)

Concurrent engineering is a systematic approach to integrated product development that emphasizes the parallelization of tasks (i.e., doing tasks simultaneously) and the early involvement of all relevant stakeholders, such as:

- Design
- Manufacturing
- Quality assurance
- Testing
- Operations

This approach helps in reducing time-to-market, improving product quality, and identifying potential problems early in the development cycle.

Final Answer: (b) Long before the project execution

3. Explanation: (c)

1. Mining: Covered under Mines Act, 1952
2. Factories: Covered under the Factories Act, 1948
3. Ports: Covered under the Dock Workers (Safety, Health and Welfare) Act, 1986
4. Construction: Covered under the Building and Other Construction Workers (Regulation of Employment and Conditions of Service) Act, 1996

Correct Answer: (c) Mining, Factories, Ports and Construction")

4. Explanation: (c)

Statement 1: Internal audits are used to verify whether products conform to technical specifications. This is confirmed by sources that state internal audits include product audits to ensure products meet specified requirements.

Statement 2: Internal audits are also used to verify whether quality management systems are effectively implemented. Internal audits systematically examine the effectiveness and implementation of quality management systems.

Correct answer: (c) Both 1 and 2

5. Explanation: (a)

Statement 1: "It is a small group of people working in different areas of an organization with multiple expertises."

Incorrect – A Quality Circle typically consists of a small group of employees from the same work area or doing similar work, not from different areas with diverse expertise. The focus is on leveraging shared experiences in a common work environment to solve problems.

Statement 2: "It consists of people who volunteer themselves."

Correct – Participation in a Quality Circle is voluntary. Members choose to join and contribute to problem-solving efforts.

Statement 3: "It is a human resource development technique."

Correct – Quality Circles serve as a HRD tool, enhancing employee involvement, motivation, teamwork, communication, and problem-solving skills.

Statement 4: "It is a problem-solving forum."

Correct – One of the main purposes of a Quality Circle is to identify, analyze, and solve work-related problems and improve productivity and quality.

Correct Answer: (a) 2, 3 and 4 only

6. Explanation: (b)

Statement (I): Total Productive Maintenance (TPM) is productive maintenance involving total participation as a group activity.

True — TPM is a holistic approach to maintenance that involves everyone in the organization — from top management to frontline operators — in maintaining and improving equipment. It emphasizes proactive and preventive maintenance to improve equipment reliability and involves team-based activities.

Statement (II): Under the aegis of TPM, individual operators generally take care of minor maintenance aspects.

True — One of the key pillars of TPM is Autonomous Maintenance (Jishu Hozen), where operators are empowered and trained to take care of basic maintenance tasks like cleaning, lubricating, and inspecting their equipment. This frees maintenance teams to focus on more complex tasks.

While Statement II is a true component of TPM, it describes only one specific aspect — autonomous maintenance. Statement I refers to the broader concept of TPM, including all 8 pillars (planned maintenance, quality maintenance, training, etc.).

So, Statement II is related to I, but not the full explanation.

Final Answer: (b) Both Statement (I) and Statement (II) are individually true, but Statement (II) is not the correct explanation of Statement (I)

7. Explanation: (c)

Statement (I): "Quality is essential for survival and growth of an organisation in the procont era of tough competition."

- True.
- In today's highly competitive global environment, maintaining high quality in products and services is crucial for customer satisfaction, brand reputation, and sustainability.
- Quality contributes directly to market competitiveness and organizational growth.

Statement (II): "The concept of quality is confined only to construction and manufacturing organisations."

- False.
- Quality is a universal concept applicable across all sectors — including services, healthcare, education, IT, finance, government, and more.
- For example, service quality in a bank or patient care quality in a hospital is just as critical as product quality in manufacturing.

8. Explanation: (c)

Statement (I): True

Prevention costs are the **costs incurred to avoid defects** in products or services.

These **increase** with the implementation of a quality system (like ISO 9001) because investments are made in processes, audits, tools, training, etc.

These can indeed become a **significant proportion** of the total quality costs in a well-managed system where the goal is to prevent defects rather than fix them later.

Statement (II): False

Incorrect claim: Education and training **are** part of **prevention costs**.

According to standard quality cost models (like the Cost of Quality model), **training, education, quality improvement projects, and preventive maintenance** are all part of **prevention costs**.

Final Answer: (c) Statement (I) is true but Statement (II) is false.

9. Explanation: (b)

Let's evaluate each statement in the context of Total Quality (Total Quality Management – TQM):

1. Opportunity to improve – Correct
   TQM emphasizes continuous improvement. Every process and product is seen as having potential for enhancement.
2. Adoption requires little change – Incorrect
   TQM often requires significant cultural and procedural changes across the organization. It demands commitment at all levels and may overhaul traditional practices.
3. React to competitive threats – Partially correct but not a core TQM principle
   While TQM can help an organization stay competitive, it is primarily proactive and customer-focused, not merely reactive.

Correct Answer: (b) 1 and 3 only

10. Explanation: (c)

W. Edwards Deming's System of Profound Knowledge is made up of four interrelated components:

1. Appreciation for a system (knowledge of the system)
2. Knowledge of variation (theory of variation)
3. Theory of knowledge
4. Knowledge of psychology

Let's match with the given options:

1. Knowledge of psychology
2. Knowledge of the theory of variation
3. Knowledge of process (this is not explicitly one of the four components)
4. Knowledge of the system and the theory of optimization (covers "appreciation for a system")

So, the correct answer is: (c) 1, 2 and 4 only

11. Explanation: (d)

(a) Analysis and design
Thorough analysis and good design reduce the risk of defects and failures — a critical method to prevent product liability.

(b) Quality control
Ensures products meet design specifications and are free of defects — also essential for liability prevention.

(c) Comprehensive testing
Verifies that the product performs safely and reliably under expected conditions — key preventive step.

(d) Cost
Cost itself is not a method to prevent liability. While managing cost is important in production, focusing on cost over safety or quality can increase liability risk. So, cost is not a preventative approach, and cutting corners to reduce cost can actually increase liability.

Correct Answer: (d) Cost

12. Explanation: (b)

1. **Ad hoc committee for the zero defects program**
   Yes — this is **Step 5** in Crosby's 14-step plan:
   "Establish an ad hoc committee for the Zero Defects program."
2. **Cost of quality evaluation**
   Yes — this is **Step 3** in Crosby's plan:
   "Measure the cost of quality to identify areas of improvement."
3. **Quantity measurements**
   No — Crosby emphasizes **quality**, not quantity. Measurement is focused on **quality performance**, not production volume.
4. **Supervisor training**
   Yes — this is **Step 6**:
   "Supervisor training in quality improvement."

Correct Answer: (b) 1, 2 and 4

13. Explanation: (c)

Why "Lack of understanding of variation" is a deadly disease

1. Leads to knee-jerk management
   Managers fire off changes every time the numbers twitch, instead of letting the process run its course and using control charts to distinguish signal from noise.
2. Undermines continuous improvement
   Genuine improvement depends on identifying and eliminating true "special causes" and then reducing common-cause variation. If you can't tell them apart, you can't improve.
3. Erodes morale and trust
   People get whipsawed by shifting "directives" as management interprets every fluctuation as a crisis. That destroys buy-in for real, data-driven change.

14. Explanation: (b)

Statement 1: This is incorrect because it mentions "quantity" instead of "quality".

- The principal objective focuses on quality — meeting customer requirements, not the volume of production.

Statement 2:

- This is a key internal objective — known as quality assurance for management.
- Ensures that internal processes are capable of consistently delivering the intended quality.

Statement 3: This is the external quality assurance objective — giving customers confidence in the product or service.

Final Answer: (b) 2 and 3 only

15. Explanation: (d)

Quality characteristics are commonly grouped into the following categories:

1. Sensory characteristics
   These involve human perception—like taste, color, feel, sound, and smell.
2. Structural characteristics
   These refer to physical and material aspects of a product, such as strength, design, and integrity.
3. Statistical characteristics
   While statistical methods are used to analyze quality, "statistical characteristics" are not typically considered a distinct *category* of quality characteristics.
4. Time-oriented characteristics
   These include reliability, durability, maintainability, and serviceability—how the product performs over time.

Conclusion: Option (d) 1, 2 and 4 only is the most accurate.

16. Explanation: (b)

Quality costs are typically categorized into four major categories under the Cost of Quality (CoQ) model:

1. Prevention Costs
   Costs incurred to prevent defects, such as training, process control, and quality improvement programs.
2. Appraisal Costs
   Costs associated with measuring and monitoring activities, such as inspection and testing.
3. Production Costs
   These are general manufacturing costs and not a recognized category of quality cost.
4. Internal Failure Costs
   Costs arising from defects detected before the product reaches the customer, such as rework and scrap.

Therefore, the correct set of quality cost categories among the options given is: (b) 1, 2 and 4 only.

17. Explanation: (b)

1. Increase in the cost of production
- Higher costs reduce profit margins and competitiveness, especially if not matched by price increases.
- Correct
2. Decrease in the quantity of production
- Lower output can mean underutilization of resources, leading to loss of revenue and inefficiency.
- Correct
3. Quality of product not meeting standards/customer expectations
- Poor quality leads to customer dissatisfaction, returns, reputation loss, and decreased sales.
- Correct
4. Producing more quantity than can be sold, leading to accumulation of stock
- Overproduction leads to excess inventory, increased holding costs, and cash flow problems.
- Correct

Final Answer: (b) 1, 2, 3 and 4

18. Explanation: (a)

- Statement (I) correctly describes the role of a machine shop — it works with stock material and finishes castings/forgings that need machined surfaces.
- Statement (II) explains how a machine shop achieves this: by removing metal through operations like milling, facing, drilling, etc., either to smooth a surface or to create one.

Since Statement (II) directly explains why machining is done in a machine shop, it serves as a valid explanation of Statement (I).

The correct answer is: (a)

Both Statement (I) and Statement (II) are true, and Statement (II) is the correct explanation of Statement (I).

Unit 5.2: Statistical Tools and Sampling Techniques

Previous Year Exam Questions

[ESE 2017 PAPER – 1]

1. The maximum percentage defects that a consumer may find definitely acceptable is called

(a) AOQL (b) LTPD
(c) AQL (d) AOQ

[ESE 2019 PAPER – 1]

2. A unit produces packing boxes. Out of hourly production of 4,000 boxes, 20 were found to be non-