RPSC AEn-2024 Main Test Series

STREAMS : CE, ME, EE

Test 9

Test Mode : • Offline • Online

Subject : Social Aspects of Engineering: Part -1

(Project Planning, Appraisal and feasibility study, Environmental degradation and sustainable development, Innovation for development of the society)

DETAILED EXPLANATIONS

1. **Solution:**
It is a technique to smooth resource usage by rescheduling non-critical tasks without changing project duration.

2. **Solution:**
It is the process of shortening project duration by adding resources to critical path activities.

3. **Solution:**
It is the discount rate at which the Net Present Value of all cash flows becomes zero.

4. **Solution:**
Fixed costs are constant expenses like rent; variable costs change with production like raw materials.

5. **Solution:**
It is the systematic reduction in the recorded value of an asset over time due to wear, tear, or obsolescence.

6. **Solution:**
PERT is used in Research and Development, defense, and space programs where time estimates are uncertain.

7. Solution:
Pollution is the introduction of harmful contaminants into the natural environment. Its types include air, water, soil, noise, and thermal pollution.

8. Solution:
It occurs through excessive use of fertilizers and pesticides, soil erosion, and groundwater depletion.

9. Solution:
It is caused by mining, deforestation, over-population, industrialization, and excessive fossil fuel consumption.

10. Solution:
Sustainability refers as meeting present needs without compromising the ability of future generations to meet theirs.

11. Solution:
The sources of water pollution include industrial effluents, untreated sewage, agricultural runoff, oil spills, and marine dumping.

12. Solution:
They release greenhouse gases, sulfur dioxide, and fly ash, causing air pollution and global warming.

13. Solution:
They are Reduce, Refuse, Reuse, Re-purpose, Repair, Recycle Right, Remove and Rally.

14. Solution:
Reduce implies minimizing resource usage, while Reuse means using items again for the same purpose.

15. Solution:
It is an economic system aimed at eliminating waste through sharing, repairing, and recycling resources.

16. Solution:
It envisions a "Lifestyle for Environment" replacing consumerism with mindful, pro-planet resource utilization.

17. Solution:
It means actively and skillfully questioning, analyzing, interpreting, and evaluating information to form a reasoned judgment or decision.

18. Solution:

Trademarks protect brand identity, while Trade Secrets protect confidential business information and processes.

19. Solution:

Social Media platforms are used for networking and sharing content. Their examples include Facebook, X (Twitter), LinkedIn, Instagram, etc.

20. Solution:

Digital India is a mission to transform India into a digitally empowered society and knowledge economy.

21. Solution:

The three-time estimates used in PERT are:

- **Optimistic Time (t_o):** The minimum possible time required to complete a task, assuming everything proceeds better than expected.
- **Pessimistic Time (t_p):** The maximum possible time required to complete a task, assuming everything goes wrong.
- **Most Likely Time (t_m):** The best estimate of the time required to complete a task, assuming normal conditions.

22. Solution:

It is the specific level of activity where total revenue equals total costs, resulting in no profit or loss. It serves as a critical financial milestone. It can be achieved by:

1. **Reducing Costs**: Lowering fixed overheads (rent) or variable costs (materials).
2. **Increasing Revenue:** Raising the unit selling price or boosting the sales volume.

23. Solution:

Resources are critical assets required to execute a project and are classified as:

1. **Human Resources:** The workforce, spanning skilled labor to project managers.
2. **Physical Resources:** Tangible assets like machinery, equipment, raw materials, and facilities.
3. **Financial Resources:** The capital budget and cash flow required for expenses.
4. **Time and Information:** Often considered intangible but vital resources for planning and execution.

24. Solution:

Electrostatic Precipitator removes particulate matter from exhaust gases using electrostatic forces:

Working Principle:

1. **Ionization:** Polluted gas passes through a high-voltage discharge electrode, ionizing the air.
2. **Charging:** Dust particles collide with ions and acquire a negative charge.
3. **Collection:** Charged particles are attracted to positively charged collecting plates.
4. **Removal:** Plates are vibrated to drop dust into hoppers for disposal.

25. Solution:

Unplanned and rapid industrial growth disrupts biodiversity and ecosystems through:

1. **Habitat Fragmentation:** Large-scale infrastructure projects divide natural habitats, isolating species populations.
2. **Pollution:** Industrial effluents alter the pH and oxygen levels of water bodies, killing aquatic life.
3. **Deforestation:** Clearing forests for factories leads to loss of flora and displacement of fauna.
4. **Climate Change:** Greenhouse gases emissions alter temperature patterns, forcing species migration or extinction.

26. Solution:

Mining operations lead to severe landscape alteration, including soil erosion and the formation of sinkholes. It causes acid mine drainage which contaminates groundwater with heavy metals. Furthermore, the process releases significant dust and particulate matter, causing air pollution and destroying local vegetation cover.

27. Solution:

Mitigation involves a multi-layered approach starting with strict enforcement of environmental regulations and impact assessments.

These multi-pronged approaches are:

1. **Regulatory Control:** Strict enforcement of environmental laws and mandatory Environmental Impact Assessments (EIA).
2. **Sustainable Practices:** Adopting the 3R principle (Reduce, Reuse, Recycle) in industries.
3. **Green Technology:** Using renewable energy and clean production methods like electrostatic precipitators.
4. **Ecological Restoration:** Afforestation programs and reclamation of mined lands to restore balance.

28. Solution:

Typically, there are five strategies for risk mitigation:

1. **Avoidance:** It eliminates the risk source entirely.
2. **Reduction (Mitigation):** It lowers the probability or impact of the risk.
3. **Transfer:** It shifts the financial burden to a third party like an insurance company.
4. **Acceptance:** Here, the risk is acknowledged without taking action.
5. **Contingency Planning:** Preparing action plans for worst-case scenario.

29. Solution:

Start-up India Scheme aims to build a strong ecosystem that nurtures innovation and drives sustainable economic growth. The key objectives include simplifying regulatory compliances, providing funding support and tax benefits, fostering industry-academia partnerships through incubation centers, and transforming the country from a nation of job seekers to job creators.

30. Solution:

Start-up ecosystem at the grass-root level faces following challenges:

1. **Access to Capital:** Investors are often concentrated in metro cities, ignoring rural potential.
2. **Digital Divide:** Poor internet connectivity and lack of hardware hamper tech integration.
3. **Talent Shortage:** Difficulty in retaining skilled professionals in non-urban areas.
4. **Market Linkages:** Lack of supply chains to connect local products with national markets.

31. Solution:

Intellectual Properties Right (IPR) is legally classified into several categories based on the nature of the creation:

1. **Patents:** For new technical inventions.
2. **Copyrights:** For literary and artistic works.
3. **Trademarks:** For brand logos and symbols.
4. **Trade Secrets:** For confidential business processes.
5. **Geographical Indications:** For region-specific products.
6. **Industrial Designs:** For protecting the ornamental or aesthetic aspects of a product

32. Solution:

Major Advantages of Social Media

1. Global Connectivity
2. Information and Education
3. Business and Marketing
4. Career Opportunities
5. Creative Expression
6. Awareness and Social Change

Major Disadvantages of Social Media

1. Mental Health Issues
2. Privacy Issues
3. Cyberbullying and Harassment
4. Fake news and propaganda
5. Lead to addiction
6. Reduced Real-World Interaction

33. Solution:

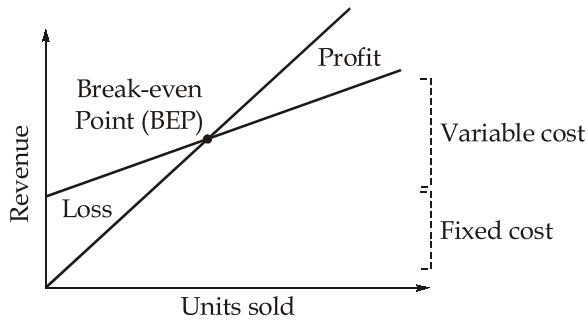
Break-even analysis is a financial assessment tool used by businesses to determine the specific level of output or sales volume at which total revenues exactly equal total costs. At this precise juncture, known as the Break-even Point (BEP), the enterprise generates zero profit and incurs zero loss.

The formula for determining the break-even point in units is:

$$\text{Break Even Point} = \frac{\text{Fixed cost}}{\text{Selling price per unit-Variable cost per unit}}$$

or,
$$\text{Break Even Point} = \frac{\text{Fixed cost}}{\text{Contribution Margin per unit}}$$

The analysis relies heavily on distinguishing between fixed costs (e.g., rent, insurance), which remain constant regardless of output, and variable costs (e.g., raw materials), which fluctuate directly with production volume. The difference between the selling price and the variable cost is called the contribution margin, which goes toward paying off fixed costs.



Advantages

1. **Strategic Viability:** It is indispensable for startups and new product launches to determine if a business model is financially sustainable before capital is invested.
2. **Margin of Safety:** It allows managers to calculate how much sales can drop before the business actually begins to suffer a loss, acting as a risk management tool.
3. **Price and Cost Control:** It visualizes how changes in pricing strategies or rising variable costs will impact the bottom line, aiding in quicker management responses.

Limitations

1. **Unrealistic Linearity:** The model assumes that variable costs and selling prices remain constant per unit at all scales. In reality, bulk buying discounts or market saturation often change these figures.

2. **Production vs. Sales:** It assumes that everything produced is sold immediately, ignoring the costs and realities of holding inventory.
3. **Multi-Product Complexity:** It is difficult to apply to companies with diverse product lines, as allocating fixed costs accurately across different products is often arbitrary.

34. Solution:

Noise pollution is defined as unwanted or excessive sound that can have deleterious effects on human health, wildlife, and environmental quality.

Sources of Noise Pollution

1. **Transportation:** This is the primary culprit, including road traffic, aviation noise, and railway operations.
2. **Industrial Activity**: Factories, mills, and industries use heavy machinery, generators, and exhaust fans that produce high-intensity noise.
3. **Construction**: Urban development involves drilling, pile driving, and heavy earth-moving equipment, creating significant localized noise.
4. **Social and Household Events**: Use of loudspeakers during festivals, concerts, firecrackers, and household appliances like mixers and vacuum cleaners contribute to ambient noise.

Impacts of Noise Pollution

1. **Human Health:** Prolonged exposure can lead to Noise-Induced Hearing Loss, tinnitus, and cardiovascular issues like hypertension.
2. **Psychological Effects:** It causes chronic stress, sleep disturbance, anxiety, and reduced cognitive performance in children.
3. **Wildlife:** Noise disrupts animal communication, interferes with navigation, and causes behavioral changes or migration.

Control Measures

1. **Green Belts:** Planting trees along roads and industrial areas acts as a buffer, as vegetation absorbs sound waves.
2. **Technological Interventions:** Mandating better silencers for vehicles, soundproofing industrial machinery, and using noise-canceling barriers on highways.
3. **Urban Planning:** Strictly zoning industrial areas away from residential zones and establishing Silence Zones near hospitals and schools.
4. **Legal Enforcement:** Enforcing decibel limits on loudspeakers and restricting construction activities during night hours.

35. Solution:

Biodiversity in Rajasthan faces severe stress due to its fragile arid ecosystem. The primary threats include:

1. **Extensive mining:** Extensive mining of sandstone and marble, and urbanization sever wildlife corridors, isolating populations like the Great Indian Bustard.
2. **Invasive Species:** The proliferation of Prosopis juliflora has decimated native flora, altered soil composition and reduced fodder.
3. **Desertification:** Overgrazing and deforestation are accelerating the eastward expansion of the Thar Desert.
4. **Climate Change:** Erratic monsoons and receding groundwater levels threaten water-dependent ecosystems like Keoladeo National Park.

Role of Aravalli Range in Conservation

The Aravalli Range is the ecological backbone of Rajasthan:

1. **Green Wall:** It acts as a physical barrier preventing the desert sands from engulfing the fertile Indo-Gangetic plains.
2. **Water Tower:** The fractured rock system serves as a critical groundwater recharge zone for North India.
3. **Climate Regulator:** It checks the velocity of desert winds and guides the Arabian Sea branch of the monsoon towards the Himalayas.

Recent Aravalli Range Controversy (2025-26)

The recent controversy centers on the legal definition of Aravalli Hills.

The 100-Meter Rule: In November 2025, the Supreme Court accepted a definition classifying only landforms rising 100 meters or more above local relief as "Aravalli Hills." Assessments revealed this height-based metric would exclude nearly 90% of the range (protecting only approximately 1,000 out of more than 12,000 hills), effectively opening vast ecologically sensitive areas to mining.

Recognizing that these lower ridges are vital for watershed protection, the Supreme Court stayed its own order in December 2025. This stay was a necessary judicial correction to prevent the legitimization of mining in ecologically sensitive zones under the guise of technical definitions.

Conclusion: The Aravallis cannot be defined by height alone; they must be viewed as an integrated hydrological system. The "Aravalli Green Wall Project" offers a viable path forward for restoration.

36. Solution:

Renewable Resources are natural assets that can be replenished or reproduced by physical, chemical, or biological processes within a human timescale. Examples: Solar energy, wind, water, forests, and wildlife.

Non-Renewable Resources are those which have a limited stock. Once the stocks are exhausted, it may take thousands of years to renew or replenish them. Examples: Fossil fuels (coal, petroleum), minerals, and nuclear fuels.

Impacts of Indiscriminate Usage of Renewable Resources on Biodiversity

While renewable resources are cleaner, their reckless exploitation poses severe threats to biodiversity.

1. **Habitat Destruction:** Indiscriminate logging for timber or firewood and clearing forests for agriculture (e.g., shifting cultivation) destroys the natural habitat of countless species, leading to fragmentation and extinction.
2. **Biofuels:** The push for biofuels often leads to monoculture plantations (e.g., Palm Oil, Eucalyptus). These single-species crops lack ecological complexity, supporting far fewer species than the natural forests they replace.
3. **Aquatic Ecosystem Collapse:** Excessive damming of rivers for hydropower disrupts natural flow regimes, blocking fish migration routes and trapping nutrient-rich sediments, starving downstream deltas.
4. **Conflict with Wildlife:** Large-scale renewable energy projects require vast tracts of land. Wind turbines and transmission lines pose collision risks for avifauna, a critical threat to endangered birds like the Great Indian Bustard in Rajasthan.
5. **Soil Degradation:** Over-intensive agriculture depletes soil microorganisms and nutrients, turning fertile land into barren wastelands where native flora cannot survive.

Conclusion: Renewability does not imply immunity to damage. Sustainable management, such as Social Forestry and Environmental Impact Assessments (EIA) for green projects, is essential to ensure that the quest for energy security does not compromise ecological integrity.

37. Solution:

With the advent of affordable data and smartphones, and the success of Digital India initiative, social media has evolved from a leisure tool into a potent catalyst for rural transformation. It acts as a great equalizer, bridging the information gap between urban centers and the rural hinterland.

Key Contributions

1. **Agricultural Revolution:** Platforms like YouTube and WhatsApp function as digital extensions, enabling farmers to access real-time weather updates, modern cropping techniques, and market prices (e-NAM). This reduces information asymmetry and dependency on exploitative middlemen.
2. **Economic Empowerment:** Social media provides a direct marketplace for rural artisans and Self-Help Groups (SHGs). By showcasing products on Instagram or Facebook, they access global markets, bypassing traditional supply chains and enhancing income.

3. **Governance and Accountability:** It has democratized governance. Rural citizens now use platforms like X (Twitter) to raise grievances directly to District Magistrates or ministries, forcing quicker administrative responses. It also aids in the rapid dissemination of welfare schemes (e.g., MGNREGA, PM-KISAN).
4. **Social Awareness:** It serves as a vehicle for behavioral change, spreading awareness about sanitation (Swachh Bharat), vaccination drives, and gender equality, challenging regressive social norms.
5. **Education and Health:** It facilitates distance learning and telemedicine awareness, which is crucial for where physical infrastructure is lacking.

Challenges and Concerns

However, this digital penetration is not devoid of risks:

1. **The Digital Divide:** Access remains skewed towards men and younger demographics, leaving women, elderly and marginalized communities behind, potentially widening existing socio-economic gaps.
2. **Misinformation and Social Unrest:** Low media literacy makes rural populations vulnerable to fake news and rumors, which can trigger communal tension or mob violence.
3. **Cyber Vulnerability:** Increasing reliance on digital platforms without adequate cyber-hygiene exposes rural users to financial frauds and phishing.

Conclusion: Social media is a double-edged sword. To harness its full potential, infrastructure expansion (BharatNet) must be complemented by robust Digital Literacy campaigns. The goal should be to turn rural users from passive consumers of content into informed, productive digital citizens.

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