

Paper Code : 02



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RPSC AE MAINS

SOLUTIONS

SOCIAL ASPECTS OF ENGINEERING

Paper-II

Exam Date :- 22 March 2025

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PAPER-II : SOCIAL ASPECTS OF ENGINEERING

Total Marks: 100
Total Question: 26

Part - A

Note: Attempt all questions. Answer each question in 15 words. Each question carries 2 marks.

1. **What is 'Risk mitigation' in the context of a sustainable life style?**
Sol. Risk mitigation in sustainable life cycle reduces environmental impact, conserves resources, ensures long-term ecological balance.
2. **What is the fundamental difference between linear and circular economy?**
Sol. Unlike the linear economy (take-make-dispose model), a circular economy promotes reusing, repairing, refurbishing, and recycling to create a closed-loop system.
3. **What are the major environmental challenges associated with stone crushing industries?**
Sol.
 - Dust Pollution
 - Water Pollution
 - Land Degradation
 - Noise Pollution
 - Safety Risks
 - Biodiversity Loss
4. **What is meant by precision agriculture?**
Sol. Precision Agriculture is use of technology (GPS, sensors, drones, AI etc.) to monitor and manage crop accurately.
5. **How is the Blockchain Policy envisaged by the Government of Rajasthan expected to transform governance systems and digital service delivery?**
Sol. Rajasthan Blockchain Policy enhances transparency, security, efficiency, trust, and streamlines digital governance and public service delivery.
6. **What is Industry 4.0?**
Sol. Industry 4.0 integrates automation, data exchange, IoT, AI, transforming manufacturing into smart, connected, efficient systems.
7. **What does Internal Rate of Return signify?**
Sol. Internal Rate of Return (IRR) is the discount rate at which the Net Present Value (NPV) of a project becomes zero. It signifies the profitability of the investment; higher IRR indicates a more desirable project.
8. **What is critical path in project management?**
Sol. Critical Path is the longest sequence of activities in a project network that determines the minimum time required to complete the project. Any delay in these activities will directly delay the entire project.
9. **What are the key attributes of a Smart City?**
Sol. Smart cities ensure sustainability, efficient infrastructure, digital connectivity, governance, citizen participation, safety, and improved quality of life.
10. **Why is SAP so popular in project management?**
Sol. SAP is popular in project management because it provides integrated planning real time monitoring and efficient resource management. It helps in better control of cost time and resources and improves decision making for successful project execution.



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11. How does Artificial Intelligence help in project management?

Sol. Artificial Intelligence improves project management through automation, predictive analytics, risk assessment, decision-making, and resource optimization.

12. What is life cycle costing?

Sol. Life cycle costing is the total cost of a project or asset over its entire life including initial cost operation maintenance and disposal costs. It helps in selecting the most economical option by considering all costs from beginning to end.

13. What are the main biodiversity impediments caused by renewable energy?

Sol. Renewable energy projects cause habitat loss, species displacement, land use change, noise, visual disturbance, and ecosystem fragmentation.

14. What are the main functions of the World Trade Organisation?

Sol. The fundamental goal of the WTO, as set out in the organization's founding agreement, is to use trade as a means to improve people's living standards, create better jobs and promote sustainable development.

15. What is the principle of 'Antyodaya'?

Sol. The principle of Antyodaya (meaning "upliftment of the last person") is a social and political philosophy that emphasizes prioritizing the welfare of the poorest and most marginalized individuals in society.

Part - B

Note: Attempt all questions. Answer each question in 50 words. Each question carries 05 marks.

16. What do you mean by carbon credit? How do they work?

Sol. Carbon credit is a market-based instrument used to control greenhouse gas emissions. One carbon credit represents the permission to emit one ton of carbon dioxide or its equivalent. It is an important tool for promoting sustainable development and reducing global warming.

Working of carbon credits

1. Cap and trade system

A limit is set on total emissions and companies are given a fixed number of carbon credits.

2. Emission controls

Each company must keep its emissions within the allowed limit.

3. Trading mechanism

If a company emits less, it can sell extra credits. If it emits more it must buy credits.

4. Incentive for clean technology

Companies are encouraged to use energy efficient and low pollution technologies.

5. Environmental benefit

This system helps in reducing overall pollution and supports sustainable growth.

17. Examine the economic consequences of poor access to healthcare services in rural India.

Sol. Poor access to healthcare in rural India leads to serious economic consequences affecting individual households and the overall economy.

1. Increased out of pocket expenditure

People spend a large portion of their income on medical treatment which often leads to financial stress and debt.

2. Rise in poverty levels

High healthcare costs and loss of income due to illness push many rural families into poverty and worsen existing inequalities.



3. Loss of productivity

Poor health reduces the working capacity of individuals leading to lower agricultural and economic output.

4. Higher mortality and disease burden

Lack of timely treatment increases maternal mortality infant mortality and malnutrition which negatively affects human capital development.

5. Migration and economic imbalance

People migrate to urban areas for better healthcare and jobs causing imbalance in rural economy and labour shortage.

6. Long term economic slowdown

A weak and unhealthy workforce hampers economic growth and development in rural regions. Overall poor healthcare access creates a cycle of poverty low productivity and underdevelopment in rural India.

18. Discuss the economic and technical aspects of HPCL Rajasthan Refinery Project.

Sol. The HPCL Rajasthan Refinery Project (HRRL) is a major greenfield refinery and petrochemical complex located at Pachpadra in Barmer district. It is a joint venture between HPCL and the Government of Rajasthan.

Economic Aspects**1. Large scale investment**

The project involves an investment of about Rs 43,000–Rs 70,000 crore, boosting regional and national economy.

2. Employment generation

It creates thousands of direct and indirect jobs, improving livelihood in western Rajasthan.

3. Industrial development

Promotes petrochemical industries and development of an industrial hub in the Barmer region.

4. Infrastructure growth

Leads to development of roads, rail connectivity, healthcare and education facilities in nearby areas.

5. Revenue and energy security

Reduces dependence on imports and increases government revenue through taxes and exports.

Technical Aspects**1. Refinery capacity**

Designed with a capacity of about 9 MMTPA, including petrochemical production.

2. Crude oil processing

Processes a mix of imported crude and Rajasthan crude oil through advanced refining units.

3. Modern technology

Uses state of the art and energy efficient systems for refining and petrochemical production.

4. Integrated petrochemical complex

Includes units like distillation, cracking, polymer production (polyethylene and polypropylene).

5. Logistics and supply system

Connected through pipelines for crude supply and transport of petroleum products.

The HPCL Rajasthan Refinery Project is a major step towards economic growth, industrialization and energy security, supported by advanced refining technologies and infrastructure development in Rajasthan.





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19. What is resource smoothing? How does it affect the project schedule?

Sol. Resource smoothing is a project management technique used to adjust the distribution of resources without changing the project duration. It ensures that resource usage is uniform and within limits.

Effect on project schedule

1. No change in project duration

The overall completion time of the project remains the same.

2. Uses float of non-critical activities

Activities with float are shifted within their available time without affecting the critical path.

3. Better resource utilization

Prevents over allocation and under-utilization of resources.

4. Improved efficiency

Leads to smooth workflow and reduces idle time.

5. Maintains project stability

Ensures that the project progresses without sudden peaks and shortages of resources.

Overall resource smoothing improves resource management while keeping the project schedule unchanged.

20. Discuss the interdependence of social structure, economic growth, environmental sustainability and technological advancement in achieving holistic development in developing economies.

Sol. Holistic development in developing economies depends on the balanced interaction of social economic environmental and technological factors. These elements are closely interconnected and influence each other.

1. Social structure and economic growth

An inclusive social structure with education equality and health improves human capital which increases productivity and economic growth.

2. Economic growth and environmental sustainability

Economic development provides resources for environmental protection but uncontrolled growth can lead to pollution and resource depletion. Sustainable practices are necessary for long term growth.

3. Role of technology

Technological advancement improves efficiency reduces costs and promotes clean energy and sustainable industrial practices.

4. Social and environmental link

Social awareness and participation help in conservation of resources and adoption of eco-friendly practices.

5. Integrated development

When social equity economic progress environmental protection and technology work together it leads to balanced and sustainable development.

Overall these factors are interdependent and must be developed simultaneously to achieve holistic development in developing economies.



21. What type of intellectual property rights are covered under the TRIPS Agreement? How is it helpful in protecting the interests of enterprises?

Sol. The TRIPS Agreement covers various types of intellectual property rights to protect innovations and creations.

Types of intellectual property rights under TRIPS

1. **Copyright and Related Rights:** Protects literary and artistic works (books, music, films) and computer programs.
2. **Trademarks:** Protects signs, logos, and names used to identify goods or services.
3. **Geographical Indications (GIs):** Protects names used for products that have a specific geographical origin and possess qualities or a reputation due to that origin (e.g., Champagne or Darjeeling tea).
4. **Industrial Designs:** Protects the visual design of objects that are not purely utilitarian (e.g., the shape of a bottle or a car's curves).
5. **Patents:** Protects new inventions (products or processes) in all fields of technology, provided they are new, involve an inventive step, and are capable of industrial application.
6. **Layout-Designs (Topographies) of Integrated Circuits:** Protects the original layout design of semiconductor chips.
7. **Protection of Undisclosed Information (Trade Secrets):** Protects confidential business information (like the Coca-Cola formula) from being disclosed, acquired, or used by others without consent.

How TRIPS Protects the Interests of Enterprises

- **Legal protection:** Provides exclusive rights over inventions and creations preventing unauthorized use
- **Encourages innovation:** Ensures returns on research and development investments
- **Market advantage:** Helps enterprises build brand value and competitive edge
- **Global recognition:** Offers protection in international markets under common rules
- **Prevents unfair competition:** Reduces copying and imitation of products and technologies

Overall TRIPS strengthens protection of intellectual property and supports growth and competitiveness of enterprises.

Part - C

Note: Attempt all questions. Answer each question in 200 words. Each question carries 8 marks.

22. Explain the concept of climate-resilient seed and discuss their role in ensuring food security, sustainable agriculture and farmer resilience under changing climate conditions.

Sol. Climate resilient seeds are improved varieties of crops that can tolerate extreme climatic conditions such as drought flood heat salinity and pest attacks. With increasing climate variability these seeds play a vital role in ensuring agricultural sustainability and food security.

Concept of Climate Resilient Seeds

Climate resilient seeds are developed through breeding and biotechnology to adapt to changing environmental conditions. They possess traits such as drought tolerance flood resistance early maturity and pest resistance. These seeds are suitable for regions facing irregular rainfall temperature rise and soil degradation.

Role in Ensuring Food Security**1. Stable Crop Yield**

They provide consistent production even during adverse weather conditions reducing crop failure.

2. Reduction in food shortages

Ensures continuous availability of food grains for the growing population.

3. Improved nutritional security

Some varieties are bio fortified improving quality and nutritional value of food.

Role in Sustainable Agriculture**1. Efficient use of resources**

Require less water fertilizers and pesticides leading to conservation of resources.

2. Reduced environmental degradation

Minimizes soil erosion chemical pollution and overuse of inputs.

3. Climate adaptation

Supports farming systems that can adjust to changing climate patterns.

4. Promotion of eco-friendly practices

Encourages use of organic and low input farming techniques.

Role in Enhancing Farmer Resilience**1. Risk mitigation**

Reduces vulnerability of farmers to climate shocks like droughts and floods.

2. Income stability

Ensures steady production leading to stable income and reduced distress.

3. Lower input cost

Less dependency on irrigation and chemicals reduces financial burden.

4. Improved livelihood security

Helps farmers sustain agriculture even under uncertain climatic conditions.

Challenges and Limitations**1. High cost of seeds**

Initial cost may be higher for small farmers.

2. Lack of awareness

Farmers may not be fully aware of benefits and usage.

3. Accessibility issues

Limited availability in remote rural areas.

4. Dependence on technology

Requires proper knowledge and support systems.

Climate resilient seeds are essential for achieving food security sustainable agriculture and farmer resilience in developing economies. They help in adapting to climate change reducing risks and ensuring long term agricultural productivity. Their effective implementation along with awareness and policy support can significantly strengthen the agricultural sector.





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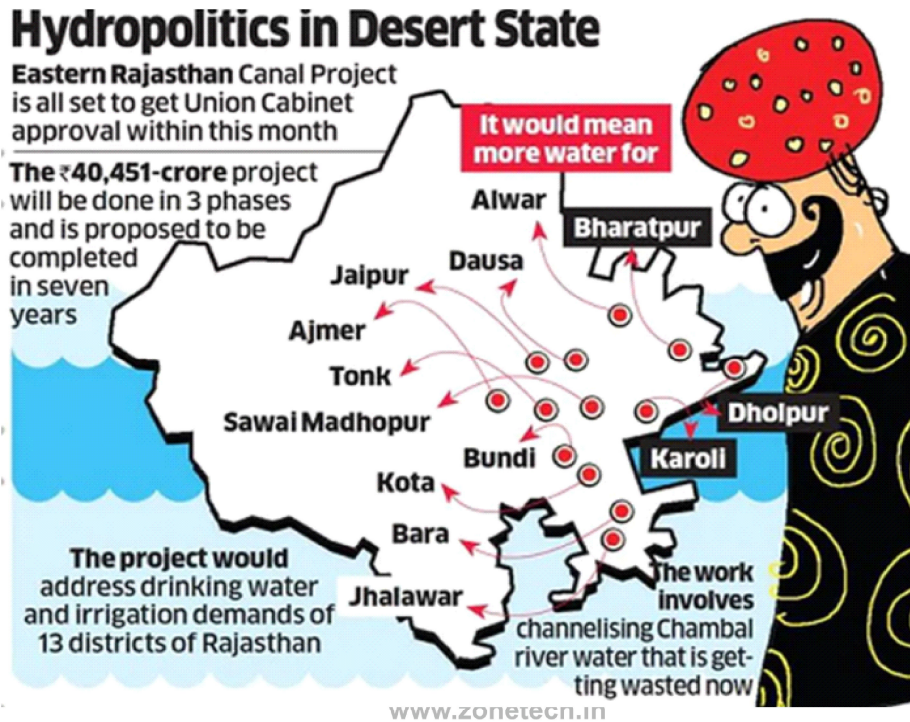
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23. Write a detailed note on Ram-Jal Setu Link Project of Rajasthan.

Sol. The Ram Jal Setu Link Project (RSLP) is a major river interlinking and water management project in Rajasthan. It is the modified form of the earlier Eastern Rajasthan Canal Project (ERCP) and aims to address the severe water scarcity in eastern Rajasthan.



Concept and Objective

The project is based on the concept of inter basin water transfer, where surplus monsoon water from rivers like Chambal, Kalisindh, Parbati, Mej and Chakan is diverted to water deficient basins such as Banas, Banganga and Gambhiri.

Key Objectives

- **Water Security:** To provide sustainable drinking water to roughly 3.25 crore people (40% of Rajasthan's population) through 2054.
- **Irrigation Expansion:** To create new irrigation facilities for 2.8 lakh to 4.3 lakh hectares of land and stabilize existing irrigation in drought-prone areas.
- **Industrial Growth:** To supply water to upcoming industrial clusters, including those along the Delhi-Mumbai Industrial Corridor (DMIC).
- **Groundwater Recharge:** To improve the water table in regions currently suffering from extreme depletion.

Key Features of the Project

1. River linking initiative

It connects multiple rivers and reservoirs to optimize water distribution.

2. Large geographical coverage

The project is expected to benefit about 17 districts of Rajasthan including Kota, Bundi, Jaipur, Ajmer and Bharatpur.

3. Irrigation development

It will irrigate around 2.5 to 2.8 lakh hectare area and stabilize existing irrigation systems.

4. Water Supply

The project aims to provide drinking water to nearly 3 crore people in water scarce regions.

5. Major engineering structures

Includes canals, pipelines, barrages and a 2.3 km long aqueduct on Chambal river.

Technical Aspects

- Utilizes gravity flow and pumping systems for water transfer
- Construction of aqueducts and canal networks for long distance water supply
- Integration of major reservoirs like Bisalpur and Isarda dams
- Designed to minimize ecological disturbance while crossing rivers like Chambal

Economic and Social Importance

1. Agricultural development
Enhances irrigation leading to increased crop productivity and farmer income
2. Industrial growth
Supports industries by ensuring reliable water supply
3. Employment generation
Creates jobs during construction and operation phases
4. Reduction in migration
Improves rural livelihoods reducing migration to urban areas
5. Balanced regional development
Helps reduce disparities between water rich and water scarce regions

Environmental Significance

- Promotes efficient utilization of surplus water
- Reduces over exploitation of groundwater
- Supports sustainable water management

Challenges

- High project cost and funding issues
- Inter-state coordination challenges
- Environmental clearance and land acquisition
- Implementation delays

Aspect	Benefits	Concerns
Water Supply	4,102.6 MCM allocation for Rajasthan	Risk of reduced flow for downstream states
Agriculture	Expanded irrigation in drought-prone areas	High construction costs, funding unclear
Ecology	Supports human needs	Threat to Chambal's biodiversity
Governance	State-Centre collaboration	Inter-state disputes unresolved

The Ram Jal Setu Link Project is a transformational water infrastructure project that aims to solve Rajasthan's water crisis through river interlinking. It plays a crucial role in ensuring water security, agricultural growth and sustainable development, making it highly significant for the future of the state.



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24. How are the software applications used in life cycle cost analysis for infrastructure and project evaluation?

Sol. Life cycle cost analysis is a method used to evaluate the total cost of an infrastructure project over its entire life including construction operation maintenance and disposal. Software applications play an important role in making this analysis accurate efficient and data driven.

Role of software in life cycle cost analysis

1. Data collection and management

Software helps in collecting and organizing large amounts of data related to costs materials labour and maintenance.

2. Cost estimation and forecasting

Advanced tools estimate initial and future costs including operation repair and replacement using predictive models.

3. Time value of money analysis

Software calculates present value net present value and internal rate of return for better financial evaluation.

4. Scenario analysis

Different alternatives and design options can be compared by changing variables such as cost inflation and life span.

5. Risk and sensitivity analysis

Helps in identifying uncertainties and evaluating how changes in input affect total project cost.

Applications in infrastructure projects

1. Design optimization

Engineers can select the most economical design by comparing life cycle costs of different alternatives.

2. Maintenance planning

Software predicts maintenance schedules and costs to ensure long term performance.

3. Asset management

Used to monitor performance and manage infrastructure assets like roads bridges and buildings.

4. Sustainability assessment

Helps in evaluating environmental and economic impacts for sustainable development.

Advantages of using software

1. Accuracy and reliability

Reduce human error and improves precision in calculations

2. Time saving

Automates complex calculations and speeds up decision making

3. Better decision making

Provides detailed reports graphs and comparisons

4. Integration capability

Can be integrated with other systems like GIS BIM and project management tools

Software applications enhance life cycle cost analysis by providing accurate efficient and comprehensive evaluation of infrastructure projects. They help in selecting cost effective sustainable and long-lasting solutions leading to better project planning and management.

25. What are the environmental challenges local industries posing in Rajasthan? Substantiate your arguments with suitable examples.

Sol. Rapid industrialization in Rajasthan especially in sectors like mining textile cement and power has contributed to economic growth but has also created serious environmental challenges. These impacts affect air water soil and overall ecological balance.

Major environmental challenges

1. Air pollution

Industries such as cement plants thermal power plants and mining activities release dust and harmful gases leading to poor air quality. Particulate matter levels in industrial regions often exceeds safe limits.

Example

Industrial areas like Kota face pollution due to thermal power plants and cement industries.

2. Water pollution

Textile dyeing chemical and petrochemical industries discharge untreated or partially treated wastewater containing toxic chemicals heavy metals and dyes.

Example

Bhilwara textile industry releases polluted effluents affecting groundwater and nearby water bodies.

3. Groundwater depletion and contamination

Industrial use of water along with discharge of pollutants leads to depletion and deterioration of groundwater quality.

Example

Many regions in Rajasthan are facing overexploitation and contamination of groundwater due to industrial and agricultural pressures.

4. Land degradation and soil pollution

Mining and industrial waste disposal degrade land quality reduce soil fertility and disturb natural landscapes.

Example

Excessive mining in Aravalli hills has led to loss of vegetation and soil erosion.

5. Loss of biodiversity and ecosystem damage

Industrial expansion and mining destroy natural habitats forests and wildlife leading to ecological imbalance.

6. Hazardous waste generation

Industries generate solid and hazardous waste which is often not properly managed causing environmental and health risks.

Example

Improper disposal of industrial waste and untreated effluents has led to environmental violations in regions like Alwar.

7. Noise and social impact

Mining and industrial operations create noise pollution and affect nearby community health and livelihood.

Example

Villagers near mining areas have complained about dust noise and blasting impacts.

Local industries in Rajasthan play a vital role in economic development but pose serious environmental challenges such as pollution resource depletion and ecological damage. Sustainable industrial practices strict regulation and adoption of clean technologies are essential to balance development with environmental protection.



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26. In what ways does social media act as a catalyst for Inclusive Rural Development and what challenges affect its effective use?

Sol. Social-media has become a powerful digital platform that connects people facilitates information exchange and promotes participation. In rural areas it plays a significant role in bridging the gap between rural and urban communities and supports inclusive development.

Role of social media in inclusive rural development

1. Improved access to information

Social-media provides timely information about government schemes agricultural practices weather forecasts health services and education which helps rural people make informed decisions.

2. Awareness and social empowerment

It increase awareness about rights welfare programs women empowerment and social justice leading to greater participation in development processes.

3. Agricultural advancement

Farmers get updates on crop techniques market prices pest control and new technologies which improves productivity and income.

4. Promotion of entrepreneurship

Local artisan small businesses and self-help groups use social media platforms to market their products and reach wider markets increasing their income.

5. Employment opportunities

It helps in sharing job information skill development programs and training opportunities for rural youth.

6. Digital and financial inclusion

Social-media supports digital payments online banking and e governance services reducing the rural urban digital divide.

7. Community engagement and governance

Citizens can raise issues interact with authorities and participate in governance which improves transparency and accountability.

8. Education and skill development

Online learning platforms tutorials and awareness campaigns help improve literacy skills and knowledge in rural areas.

Challenges in effective use of social media

1. Digital divide

Limited internet connectivity electricity and infrastructure in rural areas restrict access to social media.

2. Lack of digital literacy

Many rural people are not trained to use smartphones and digital platforms effectively.

3. Spread of misinformation

Fake news rumors and misleading content can create social and economic problems.

4. Language and cultural barriers

Most content is not available in local languages which limits understanding and usage.

5. Privacy and security concerns

Risk of cyber fraud data theft and misuse of personal information reduces trust among users.

6. Economic constraints

High cost of smartphones and internet services acts as a barrier for poor households.

7. Gender gap

Women in rural areas often have less access to digital devices and internet services.

Social media acts as a catalyst for inclusive rural development by improving access to information enhancing participation and creating economic opportunities. However its full potential can be achieved only by addressing challenges such as digital divide literacy and security ensuring equitable and effective use in rural areas.



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