GATE 2026 TF Question Paper with Solutions

Time Allowed :3 Hour	Maximum Marks :100	Total Questions :65

General Instructions

Please read the following instructions carefully:

1. This question paper is divided into three sections:
   - **General Aptitude (GA):** 10 questions (5 questions × 1 mark + 5 questions × 2 marks) for a total of 15 marks.
   - **Environmental Science and Engineering + Engineering Mathematics:**
     - **Part A (Mandatory):** 36 questions (1 questions × 1 mark + 19 questions × 2 marks) for a total of 55 marks.
     - **Part B (Section 1):** Candidates can choose either Part B1 (Surveying and Mapping) or Part B2 (Section 2). Each part contains 16 questions (8 questions × 1 mark + 11 questions × 2 marks) for a total of 30 marks.
2. The total number of questions is **65**, carrying a maximum of **100 marks**.
3. The duration of the exam is **3 hours**.
4. Marking scheme:
   - For 1-mark MCQs, $\frac{1}{3}$ mark will be deducted for every incorrect response.
   - For 2-mark MCQs, $\frac{2}{3}$ mark will be deducted for every incorrect response.
   - No negative marking for numerical answer type (NAT) questions.
   - No marks will be awarded for unanswered questions.
5. Ensure you attempt questions only from the optional section (Part B1 or Part B2) you have selected.
6. Follow the instructions provided during the exam for submitting your answers.

1. The twist per inch (TPI) of a yarn primarily affects its:

(A) Fineness
(B) Strength
(C) Length
(D) Moisture regain

Correct Answer: (B) Strength

Solution:

Step 1: Understanding twist per inch (TPI).
Twist per inch (TPI) refers to the number of turns inserted into a yarn per inch length. Twist binds the individual fibres together, improving cohesion and resistance to slippage under applied force.

Step 2: Effect of twist on yarn properties.
As the twist increases, fibres become more tightly packed, increasing inter-fibre friction. This enhances the yarn's ability to withstand tensile forces, thereby increasing its strength up to an optimum twist level.

Step 3: Analysis of options.
(A) Fineness: Fineness depends on fibre diameter and yarn count, not directly on twist.
(B) Strength: Correct — Twist significantly influences yarn strength by improving fibre cohesion.
(C) Length: Yarn length is independent of the amount of twist inserted.
(D) Moisture regain: Moisture regain depends on fibre type and environmental conditions, not twist.

Step 4: Conclusion.
Since twist directly improves fibre binding and resistance to breakage, the property primarily affected by TPI is yarn strength.

Quick Tip

Yarn strength increases with twist up to an optimum level; beyond that point, excessive twist can reduce strength due to fibre damage.

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2. Which fibre has the highest moisture regain under standard atmospheric conditions?

(A) Cotton
(B) Wool
(C) Polyester
(D) Nylon

Correct Answer: (B) Wool

Solution:

Step 1: Understanding moisture regain.
Moisture regain is the percentage of moisture a fibre absorbs from the atmosphere relative to

its dry weight under standard conditions. It reflects the hygroscopic nature of fibres.

Step 2: Comparison of fibre moisture regain.
Different fibres absorb moisture differently based on their chemical structure. Natural protein fibres generally have higher moisture regain than synthetic fibres.

Step 3: Analysis of options.
(A) Cotton: Cotton has good moisture regain but is lower than that of wool.
(B) Wool: Correct — Wool has the highest moisture regain due to its protein structure and amorphous regions that attract water molecules.
(C) Polyester: Polyester is hydrophobic and has very low moisture regain.
(D) Nylon: Nylon absorbs some moisture but significantly less than wool.

Step 4: Conclusion.
Among the given fibres, wool absorbs the maximum moisture under standard atmospheric conditions.

Quick Tip

Protein fibres like wool have higher moisture regain than cellulose fibres and synthetic fibres due to their chemical composition.

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3. In plain weave fabric, the repeat size is:

(A) 1×1
(B) 2×2
(C) 3×3
(D) 4×4

Correct Answer: (A) 1×1

Solution:

Step 1: Understanding plain weave.
Plain weave is the simplest and most fundamental type of fabric weave. In this weave, each weft yarn passes alternately over and under each warp yarn. This interlacement pattern repeats uniformly throughout the fabric.

Step 2: Meaning of repeat size.
The repeat size of a weave refers to the smallest number of warp and weft threads required to reproduce the complete weave pattern. Once this unit is repeated, the entire fabric structure

is formed.

Step 3: Analyzing the plain weave structure.
In plain weave, one warp yarn interlaces with one weft yarn in an alternating manner. This means the complete weave pattern is formed using just one warp and one weft yarn. Therefore, the smallest repeat unit consists of 1 warp $\times$ 1 weft.

Step 4: Analysis of options.
(A) 1×1**:** Correct — This is the minimum repeat needed to form a plain weave structure.
(B) 2×2**:** Incorrect — This repeat size is associated with basket or other derivative weaves, not plain weave.
(C) 3×3**:** Incorrect — This repeat size is seen in more complex weaves such as twills or satins.
(D) 4×4**:** Incorrect — Larger repeats are not required for a basic plain weave.

Step 5: Conclusion.
Since the plain weave is fully formed by the interlacement of one warp and one weft yarn, its repeat size is correctly identified as 1×1.

Quick Tip

Plain weave always has the smallest repeat size among all weaves, making it strong, simple, and widely used in fabrics like cotton and linen.

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4. The strength of a yarn is commonly expressed in terms of:

(A) Tenacity
(B) Elongation
(C) Evenness
(D) Crimp

Correct Answer: (A) Tenacity

Solution:

Step 1: Understanding yarn strength.
Yarn strength refers to the ability of a yarn to withstand tensile forces without breaking. In textile testing, strength must be expressed in a standardized and comparable manner, taking yarn thickness into account.

Step 2: Meaning of tenacity.
Tenacity is defined as the breaking force per unit linear density of the yarn. It is commonly

expressed in units such as grams per tex or centiNewtons per tex (cN/tex). This allows fair comparison between yarns of different thicknesses.

Step 3: Analysis of options.
(A) Tenacity: Correct — Tenacity directly represents yarn strength relative to its linear density and is the standard measure used in textile testing.
(B) Elongation: Elongation measures how much a yarn stretches before breaking, not its strength.
(C) Evenness: Evenness indicates uniformity of yarn thickness, not tensile strength.
(D) Crimp: Crimp refers to waviness in fibres or yarn and does not express strength.

Step 4: Conclusion.
Since yarn strength must account for yarn fineness, it is most accurately expressed in terms of tenacity.

Quick Tip

Always remember: **Strength = Force per unit linear density**, which is why tenacity is preferred over simple breaking force.

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5. The main purpose of scouring in cotton processing is to remove:

(A) Natural coloring matter
(B) Waxes and impurities
(C) Lignin
(D) Synthetic finishes

Correct Answer: (B) Waxes and impurities

Solution:

Step 1: Understanding scouring.
Scouring is a preparatory chemical process applied to cotton fabrics or yarns before bleaching and dyeing. Its main objective is to clean the cotton material thoroughly.

Step 2: Nature of impurities in cotton.
Raw cotton contains natural impurities such as waxes, oils, pectins, fats, and dirt. These substances make cotton hydrophobic and interfere with dye absorption and finishing processes.

Step 3: Analysis of options.
(A) Natural coloring matter: Removal of natural color is primarily achieved by bleaching,

not scouring.
(B) Waxes and impurities: Correct — Scouring removes hydrophobic substances like waxes, oils, and dirt, improving absorbency.
(C) Lignin: Lignin is mainly present in bast fibres, not cotton.
(D) Synthetic finishes: Synthetic finishes are applied later in processing and are not the target of scouring.

Step 4: Conclusion.
The primary purpose of scouring is to eliminate waxes and natural impurities so that cotton becomes absorbent and suitable for further processing.

Quick Tip

Scouring increases cotton absorbency, which is essential for effective bleaching, dyeing, and finishing.

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6. Which spinning system produces yarn directly from sliver without roving?

(A) Ring spinning
(B) Rotor spinning
(C) Mule spinning
(D) Cap spinning

Correct Answer: (B) Rotor spinning

Solution:

Step 1: Understanding the spinning sequence.
In conventional spinning systems, fibres pass through several stages such as carding, drawing, roving, and spinning. The roving stage is mainly used to reduce sliver thickness and insert a small amount of twist before final yarn formation.

Step 2: Concept of rotor spinning.
Rotor spinning, also known as open-end spinning, is a modern spinning method in which yarn is produced directly from sliver. The sliver is opened into individual fibres and collected in a rapidly rotating rotor where yarn formation takes place.

Step 3: Analysis of options.
(A) Ring spinning: Requires a roving stage before yarn formation and cannot spin directly from sliver.
(B) Rotor spinning: Correct — It eliminates the roving process and produces yarn directly

from sliver.
(C) Mule spinning: An intermittent spinning process that uses roving as an intermediate material.
(D) Cap spinning: A modification of ring spinning that still requires roving.

Step 4: Conclusion.
Since rotor spinning directly converts sliver into yarn without the need for roving, it is the correct answer.

Quick Tip

Rotor spinning increases productivity by eliminating the roving stage and is widely used for coarse yarn production.

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7. Polyester fibre is manufactured by the process of:

(A) Wet spinning
(B) Dry spinning
(C) Melt spinning
(D) Gel spinning

Correct Answer: (C) Melt spinning

Solution:

Step 1: Understanding fibre manufacturing processes.
Man-made fibres are produced by converting polymers into filaments using different spinning techniques. The choice of spinning method depends on whether the polymer can be melted or must be dissolved.

Step 2: Nature of polyester polymer.
Polyester is a thermoplastic polymer. It can be melted without decomposition and solidified again on cooling, making it suitable for melt-based processing.

Step 3: Explanation of melt spinning.
In melt spinning, the polymer is melted and extruded through spinnerets to form filaments. These filaments solidify upon cooling and are then drawn to improve strength and orientation.

Step 4: Analysis of options.
(A) Wet spinning: Used for polymers that cannot be melted, such as viscose rayon.
(B) Dry spinning: Used for polymers dissolved in volatile solvents, such as acetate fibres.

(C) Melt spinning: Correct — Polyester is manufactured using melt spinning.
(D) Gel spinning: Used for ultra-high molecular weight polymers like high-performance polyethylene fibres.

Step 5: Conclusion.
Since polyester can be melted and extruded without chemical degradation, melt spinning is the most suitable manufacturing process.

Quick Tip

Most synthetic fibres like polyester and nylon are produced by melt spinning due to its efficiency and solvent-free nature.
