

TF : TEXTILE ENGINEERING AND FIBRE SCIENCE

A

Duration: Three Hours

Maximum Marks: 100

Read the following instructions carefully.

1. This question paper contains 16 pages including blank pages for rough work. Please check all pages and report discrepancy, if any.
2. Write your registration number, your name and name of the examination centre at the specified locations on the right half of the Optical Response Sheet (ORS).
3. Using HB pencil, darken the appropriate bubble under each digit of your registration number and the letters corresponding to your paper code.
4. All questions in this paper are of objective type.
5. Questions must be answered on the ORS by darkening the appropriate bubble (marked A, B, C, D) using HB pencil against the question number on the left hand side of the ORS. For each question **darken the bubble of the correct answer**. In case you wish to change an answer, erase the old answer completely. More than one answer bubbled against a question will be treated as an incorrect response.
6. There are a total of 65 questions carrying 100 marks.
7. Questions Q.1 – Q.25 will carry 1-mark each, and questions Q.26 – Q.55 will carry 2-marks each.
8. Questions Q.48 – Q.51 (2 pairs) are common data questions and question pairs (Q.52, Q.53) and (Q.54, Q.55) are linked answer questions. The answer to the second question of the linked answer questions depends on the answer to the first question of the pair. If the first question in the linked pair is wrongly answered or is un-attempted, then the answer to the second question in the pair will not be evaluated.
9. Questions Q.56 – Q.65 belong to General Aptitude (GA). Questions Q.56 – Q.60 will carry 1-mark each, and questions Q.61 – Q.65 will carry 2-marks each. The GA questions will begin on a fresh page starting from page 9.
10. Un-attempted questions will carry zero marks.
11. Wrong answers will carry **NEGATIVE** marks. For Q.1 – Q.25 and Q.56 – Q.60, $\frac{1}{2}$ mark will be deducted for each wrong answer. For Q.26 – Q.51 and Q.61 – Q.65, $\frac{2}{3}$ mark will be deducted for each wrong answer. The question pairs (Q.52, Q.53), and (Q.54, Q.55) are questions with linked answers. There will be negative marks only for wrong answer to the first question of the linked answer question pair i.e. for Q.52 and Q.54, $\frac{1}{2}$ mark will be deducted for each wrong answer. There is no negative marking for Q.53 and Q.55.
12. Calculator (without data connectivity) is allowed in the examination hall.
13. Charts, graph sheets or tables are **NOT** allowed in the examination hall.
14. Rough work can be done on the question paper itself. Additionally, blank pages are provided at the end of the question paper for rough work.

Q.1 – Q.25 carry one mark each.

- Q.1 Amongst the following, the only naturally extruded fibre is
(A) Wool (B) Cotton (C) Hemp (D) Silk
- Q.2 The acrylonitrile content in the modacrylic fibre forming polymer is
(A) 85-95% (B) 40-80%
(C) 10-30% (D) 25-85%
- Q.3 For poly (ethylene terephthalate), which of the following will have the highest crystallinity?
(A) Amorphous chips (B) LOY
(C) POY (D) FDY
- Q.4 A 5 cm long filament is drawn to 20 cm. The draw ratio is
(A) 2 (B) 3 (C) 4 (D) 5
- Q.5 In which of the following regions of a carding machine, the fibre alignment is disturbed to the maximum extent?
(A) Cylinder to doffer transfer region (B) Licker-into cylinder transfer region
(C) Cylinder to cylinder under-casing region (D) Cylinder to flats carding region
- Q.6 Pressure bar is provided in a draw frame to
(A) Increase the pressure on the middle top drafting roller
(B) Reduce the intensity of drafting waves in the drafted strand of fibres
(C) Reduce the pressure on the middle top drafting roller
(D) Reduce the formation of neps in the drafted strand of fibres
- Q.7 Which of the following yarns is the finest?
(A) 10s Ne (B) 10 Tex (C) 100s Ne (D) 100 Tex
- Q.8 The rotor spun yarn has better uniformity than the ring spun yarn of same count and fibres. The reason is
(A) The high production rate of rotor spinning system
(B) The fibre doubling occurring inside the rotor
(C) The presence of wrapper fibres in rotor spun yarns
(D) In rotor spinning, twisting and winding are separated
- Q.9 In drum winding, package density is independent of
(A) Yarn tension (B) Applied package/drum pressure
(C) Yarn strength (D) Angle of wind
- Q.10 Quick response powerful brake is necessary in a high speed warping machine. Choose the **INCORRECT** reason from the following
(A) The inertia of beam is very high (B) Warping process is irreversible
(C) Buried end may result (D) Machine vibration can be minimised
- Q.11 Size add-on is **NOT** influenced by
(A) Machine speed (B) Squeeze pressure
(C) Size paste concentration (D) Drying cylinder temperature

- Q.12 The weave, that produces fabrics with maximum degree of smoothness, close packing of threads, heavy construction and high seam slippage is
 (A) Satin (B) Basket (C) Twill (D) Gabardine
- Q.13 The following has the highest Index of Irregularity
 (A) Carded sliver (B) Yarn (C) Roving (D) Drawn sliver
- Q.14 The thinnest Classimat fault among the following is
 (A) D4 (B) E (C) F (D) I2
- Q.15 The shear characteristics of fabric are measured by
 (A) KES-FB3 (B) FAST 3 (C) KES-FB2 (D) FAST 2
- Q.16 Mature cotton fibres have average degree of cell wall thickening (θ) of about
 (A) 0.1 (B) 0.2 (C) 0.6 (D) 1.0
- Q.17 In bleaching with H_2O_2 the active oxidizing species is
 (A) Water (B) Perhydroxyl ion (C) Hydrogen (D) Hydroxyl ion
- Q.18 A textile dye should have in its structure atleast
 (A) One azo and one reactive group (B) Two chromophores
 (C) One chromophore and one auxochrome (D) One solubilising and one reactive group
- Q.19 Compounds based on combination of nitrogen and phosphorus are used as
 (A) Water proofing agents (B) Antimicrobial agents
 (C) Flame retardants (D) Antistatic agents
- Q.20 Jet dyeing machines are built to be used with material to liquor ratio of
 (A) 1:1 (B) 1:50 (C) 1:30 (D) 1:8
- Q.21 If X and Y are two independent random variables, then Variance (X-Y) is
 (A) Variance (X) + Variance (Y) (B) Variance (X) - Variance (Y)
 (C) Variance (Y) - Variance (X) (D) Variance (XY)
- Q.22 The matrix $\begin{bmatrix} 1 & 3 & 2 \\ 2 & 3 & 5 \\ 1 & 4 & P \end{bmatrix}$ has one eigen value equal to 3. The sum of two other eigen values is
 (A) P (B) P+4 (C) P-1 (D) P+1
- Q.23 Cofactor of 'a' in the following determinant is
 $\begin{vmatrix} 3 & -4 & -3 \\ 2 & 7 & a \\ 5 & -9 & 2 \end{vmatrix}$
 (A) 3 (B) 5 (C) 7 (D) 9
- Q.24 A fair coin is tossed 4 times. What is the probability of getting heads 3 times?
 (A) 1/2 (B) 1/4 (C) 1/6 (D) 1/8

Q.25 The order and degree of following differential equation are

$$\left[2 + \left(\frac{dy}{dx}\right)^2\right]^2 = 5 \frac{d^2y}{dx^2}$$

- (A) 4 and 2 respectively
(C) 2 and 1 respectively

- (B) 2 and 2 respectively
(D) 2 and 5 respectively

Q. 26 – Q.55 carry two marks each.

Q.26 Match the elements of Group I and Group II.

Group I

- P. Polypropylene
Q. Cotton
R. Polyester
S. Wool

Group II

1. Poor hydrolytic stability
2. Excellent thermal resistance
3. Excellent elastic recovery
4. Poor resistance to acid
5. Higher wet strength
6. Excellent chemical resistance

- (A) P-6, Q-5, R-1, S-3
(C) P-4, Q-5, R-1, S-2

- (B) P-2, Q-5, R-6, S-3
(D) P-6, Q-1, R-2, S-3

Q.27 In the context of viscose fibre production, choose the correct statement

- (A) Ageing is an oxidative polymerization step
(B) The coagulation bath requires acid for regeneration of cellulose
(C) Ripening is carried out just before xanthation process
(D) Xanthation is necessary for converting cellulose to alkali cellulose

Q.28 Determine the correctness or otherwise of the following Assertion [a] and the Reason [r]

Assertion: The spinning speed in melt spinning process are higher than that of wet spinning process

Reason: The solidification of melt involves only heat transfer, whereas in wet spinning one way mass transfer is also involved.

- (A) Both [a] and [r] are true and [r] is the correct reason for [a]
(B) Both [a] and [r] are true and [r] is not the correct reason for [a]
(C) Both [a] and [r] are false
(D) [a] is true but [r] is false

Q.29 Match the elements of Group I and Group II.

Group I

- P. Acid dye
Q. Mordant dye
R. Reactive dye
S. Direct dye

Group II

1. Ester bonds
2. Covalent bonds
3. Electrovalent bonds
4. Co-ordinate bonds
5. Van der Waals forces
6. Ether bonds

- (A) P-3, Q-2, R-1, S-5
(C) P-5, Q-4, R-2, S-6

- (B) P-3, Q-4, R-2, S-5
(D) P-5, Q-2, R-1, S-6

Q.30 Match the elements of Group I and Group II.

Group I

- P. Thickener for printing with reactive dye
- Q. Fixation of pigment illuminated discharge on cotton
- R. Swelling agent in nylon printing
- S. Thickener for pigment printing

Group II

- 1. Saturated steam
- 2. Sodium alginate
- 3. Thiourea
- 4. Water in oil emulsion
- 5. Gum Indalca
- 6. Oil in water emulsion

- (A) P-2, Q-3, R-1, S-4
- (C) P-5, Q-1, R-6, S-4

- (B) P-5, Q-3, R-1, S-6
- (D) P-2, Q-1, R-3, S-6

Q.31 30 bales of 3.5 *Mi* and 40 bales of 4.0 *Mi* cotton fibres (*Mi* is Micronair value of cotton fibres) are already available in the raw material inventory of the mill. What is the approximate *Mi* value required of another 30 bales so that the resultant mean *Mi* of the total 100 bales will be 4.0?

- (A) 3.4
- (B) 4.7
- (C) 5.2
- (D) 6.0

Q.32 Which of the following statements are NOT true?

- (P) Ring spun yarns have higher fibre migration than DREF-2 friction spun yarns
- (Q) The rotor spun yarns have uniform twist structure across the cross-section
- (R) Air jet spun yarn is formed by fibre wrapping
- (S) Minimum number of fibres required for a particular count yarn is higher for ring spun yarns as compared to rotor spun yarns

- (A) Q,S
- (B) P,R,S
- (C) P,Q
- (D) Q,R,S

Q.33 Match the elements of Group I and Group II.

Group I

- P. Drafting waves
- Q. Periodic faults
- R. Yarn hairiness
- S. Wrapper fibres

Group II

- 1. Spinning triangle
- 2. Spinning tension fluctuations
- 3. Floating fibres
- 4. Immatured fibres
- 5. Bridging fibres
- 6. Eccentric bottom roller

- (A) P-6, Q-1, R-2, S-5
- (C) P-4, Q-6, R-1, S-2

- (B) P-3, Q-6, R-1, S-5
- (D) P-3, Q-5, R-1, S-6

Q.34 In a sizing machine, 100 m length of warp sheet was processed. The warp was stretched by 3%, 2% and 1% at unwinding zone, wet zone and drying zone respectively. The length of warp sheet on weaver's beam will be

- (A) 106.00 m
- (B) 106.11 m
- (C) 103.11 m
- (D) 100.06 m

Q.35 The propelling force generated for insertion of weft yarn in air jet weaving system is independent of the

- (A) Strength of the yarn
- (B) Length of the yarn
- (C) Diameter of the yarn
- (D) Velocity of the yarn

Q.36 Match the elements of Group I and Group II.

Group I : Technology

- P. Rope dyeing
- Q. Electronic jacquard
- R. Warp knitting
- S. Nonwoven

Group II : Product

- 1. Spacer fabric
- 2. Terry towel
- 3. Furnishing fabric
- 4. Denim
- 5. Seat belt
- 6. Tea bag

- (A) P-3, Q-2, R-1, S-5
- (C) P-1, Q-3, R-6, S-5

- (B) P-4, Q-1, R-5, S-6
- (D) P-4, Q-3, R-1, S-6

Q.37 The effective length of cotton with 21 mm lower quartile length and 25% dispersion percentage is

- (A) 15.7 mm
- (B) 21.0 mm
- (C) 26.2 mm
- (D) 28.0 mm

Q.38 100 kg of 67/33 polyester/cotton blended yarn with 4% moisture content is shipped. The standard moisture regain values of polyester and cotton are 0.4% and 8.5% respectively. The correct invoice weight is approximately

- (A) 92 kg
- (B) 96 kg
- (C) 99 kg
- (D) 104 kg

Q.39 The bending length of a fabric is 5 cm. The length of overhanging strip of the fabric specimen when the tip of it, viewed in the mirror, cuts both the index lines of fabric bending length tester is

- (A) 2.5 cm
- (B) 5 cm
- (C) 7.5 cm
- (D) 10 cm

Q.40 Determine the correctness or otherwise of the following Assertion [a] and the Reason [r]

Assertion: In effluent treatment, flocculation is used to precipitate out the organic impurities
Reason: Flocculation involves use of moderately charged polyelectrolytes

- (A) Both [a] and [r] are false
- (B) Both [a] and [r] are true and [r] is the correct reason for [a]
- (C) Both [a] and [r] are true but [r] is not the correct reason for [a]
- (D) [a] is false but [r] is true

Q.41 The Nernst isotherm represents a partition of the dye between fibre and dye solution such that the value of $[D]_f / [D]_s$

- (A) Increases with increase in concentration of dye in solution
- (B) Decreases with increase in concentration of dye in solution
- (C) Does not change with increase in concentration of dye in solution
- (D) Increases initially with increase in dye concentration and then decreases

Q.42 Choose the correct statement (s)
 To get uniform impregnation of chemicals on cotton through minimum application techniques

- (P) Material should be uniformly scoured
- (Q) Material should be bone dry
- (R) Material should contain optimum moisture
- (S) Material should be uniformly bleached

- (A) P,R
- (B) P,Q,R
- (C) P,Q
- (D) P

Q.43 The divergence of the vector field $(x - y)\hat{i} + (y - x)\hat{j} + (x + y + z)\hat{k}$ is

- (A) 0 (B) 1 (C) 2 (D) 3

Q.44 If the density function of a random variable X is given by

$$f(x) = \begin{cases} \frac{x}{2} & 0 < x < 2 \\ 0 & \text{otherwise} \end{cases}$$

then the mean value of X will be

- (A) 4/3 (B) 1/2 (C) 0 (D) 1/6

Q.45 Solution of the differential equation $\frac{d^2x}{dt^2} + 6\frac{dx}{dt} + 9x = 0$ will be

- (A) $x = (c_1 + c_2 t)e^{3t}$ (B) $x = (c_1 + c_2 t)e^{-3t}$
 (C) $x = c_1 e^{3t} + c_2 e^{-3t}$ (D) $x = c_1 e^{2t} + c_2 e^{-3t}$

Q.46 When $x \rightarrow 4$, $\lim_{x \rightarrow 4} \frac{x^3 - 64}{\log_e(x - 3)}$ will be equal to

- (A) 24 (B) 48 (C) 72 (D) 96

Q.47 For a circular rod with volume $16\pi \text{ cm}^3$, the value of radius for which the surface area (including the top and bottom surfaces) will be minimum is

- (A) 1 cm (B) 2 cm (C) 3 cm (D) 4 cm

Common Data Questions

Common Data for Questions 48 and 49:

A speed frame with all the drafting rollers of 25.4 mm diameter has the following process parameters: Roving count – 1.5s Ne; Front drafting roller speed – 220 rpm; Roving diameter – 3.0 mm; Roving Twist Multiplier – 1.2 tpi Ne^{-1/2}, Empty bobbin diameter – 76.2 mm.

Q.48 Spindle speed will be

- (A) 824 rpm (B) 968 rpm (C) 1016 rpm (D) 1106 rpm

Q.49 The ideal bobbin rack speed for the first layer of roving being directly wound on the empty bobbin will be approximately

- (A) 220 mm/min (B) 240 mm/min (C) 260 mm/min (D) 280 mm/min

Common Data for Questions 50 and 51:

A shirting cotton cloth is made from the following particulars :

Warp crimp, $C_1 = 10\%$

Warp yarn dia., $d_1 = 0.01627$ cm

$(T_2/T_1)^{1/2} = 0.8$

$K_1 = 11.3$

$K_2 = 9.1$

Fabric areal density = 91.15 g/m²

where T is yarn tex and K is the cover factor in SI unit denoted by $(\text{threads per cm})(\text{tex})^{1/2} \times 10^{-1}$.

Q.50 Thickness of the fabric will be

- (A) 0.003 cm (B) 0.033 cm (C) 0.025 cm (D) 0.005 cm

Q.51 The estimated specific volume of the fabric in cm³/g will be

- (A) 2.62 (B) 0.62 (C) 3.62 (D) 1.62

Linked Answer Questions**Linked Answer Questions Q.52 and Q.53**

Q.52 The direct twist factor of 35 Nm yarn is $36 \text{ tpcm.tex}^{1/2}$. The twist per inch of the yarn is approximately

- (A) 17 (B) 19 (C) 21 (D) 23

Q.53 If the diameter of the above yarn is 0.28 mm, the twist angle will be approximately

- (A) 10° (B) 21° (C) 30° (D) 40°

Linked Answer Questions Q.54 and Q.55

Q.54 When a blended yarn consisting of acrylic, polyester and viscose fibres is treated with 60 wt% H₂SO₄, partial dissolution is observed. The fibre/fibres that will dissolve is/are

- (A) Acrylic (B) Polyester (C) Viscose (D) Acrylic and viscose

Q.55 The undissolved part of the above experiment was further treated with 75 wt% H₂SO₄. The fibre/fibres that will not dissolve is/are

- (A) Acrylic (B) Polyester (C) Viscose (D) Acrylic and polyester

General Aptitude (GA) Questions

Q.56 – Q.60 carry one mark each.

Q.56 Which of the following options is the closest in meaning to the word below:
Ephemeral

- (A) effeminate
- (B) ghostlike
- (C) soft
- (D) short-lived

Q.57 The question below consists of a pair of related words followed by four pairs of words. Select the pair that best expresses the relation in the original pair.

Erudition : Scholar

- (A) steadfast : mercurial
- (B) competence : strict
- (C) skill : craftsman
- (D) nurse : doctor

Q.58 Choose the most appropriate word from the options given below to complete the following sentence:

The two child norms with _____ for the violators will have significant implications for our demographic profile.

- (A) disincentives
- (B) incitements
- (C) restrictions
- (D) restraints

Q.59 Choose the most appropriate word from the options given below to complete the following sentence:

There is no fixed relation between food and famine; famines can occur with or without substantial _____ in food output.

- (A) aberration
- (B) weakening
- (C) decline
- (D) deterioration

Q.60 Consider the function $f(x) = \max(7-x, x+3)$. In which range does f take its minimum value?

- (A) $-6 \leq x < -2$
- (B) $-2 \leq x < 2$
- (C) $2 \leq x < 6$
- (D) $6 \leq x < 10$

Q.61 – Q.65 carry two marks each.

Q.61 It has taken fifty six long and frustrating years to turn bronze into gold for India's Olympics aspirations. Beijing 2008 marks a defining moment in India's Olympic history. From Delhi to Beijing is a long journey but one that our Olympians have undertaken with courage.

Which of the following statements best sums up the meaning of the above passage:

- (A) India's participation in Olympics has been frustrating.
- (B) Beijing Olympics was a landmark in India's Olympic history.
- (C) Our Olympians have undertaken a long journey to Beijing.
- (D) India's bronze medal turned into gold at Beijing.

- Q.62 Consider the series $\frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{8} + \frac{1}{9} - \frac{1}{16} + \frac{1}{32} + \frac{1}{27} - \frac{1}{64} + \dots$. The sum of the infinite series above is:
- (A) ∞ (B) $\frac{5}{6}$ (C) $\frac{1}{2}$ (D) 0
- Q.63 A gathering of 50 linguists discovered that 4 knew Kannada, Telugu and Tamil, 7 knew only Telugu and Tamil, 5 knew only Kannada and Tamil, 6 knew only Telugu and Kannada. If the number of linguists who knew Tamil is 24 and those who knew Kannada is also 24, how many linguists knew only Telugu?
- (A) 9 (B) 10 (C) 11 (D) 8
- Q.64 A tank has 100 litres of water. At the end of every hour the following two operations are performed in sequence: i) water equal to $m\%$ of the current contents of the tank is added to the tank, ii) water equal to $n\%$ of the current contents of the tank is removed from the tank. At the end of 5 hours the tank contains exactly 100 litres of water. The relation between m and n is:
- (A) $m = n$ (B) $m > n$ (C) $m < n$ (D) None of the previous.
- Q.65 A student is answering a multiple choice examination with 65 questions with a marking scheme as follows: i) 1 mark for each correct answer, ii) $-\frac{1}{4}$ for a wrong answer, iii) $-\frac{1}{8}$ for a question that has not been attempted. If the student gets 37 marks in the test then the least possible number of questions the student has NOT answered is:
- (A) 6 (B) 5 (C) 7 (D) 4

END OF THE QUESTION PAPER

Space for Rough Work

Space for Rough Work

Space for Rough Work

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Space for Rough Work

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