

TF: TEXTILE ENGINEERING AND FIBRE SCIENCE

Duration: Three Hours

Maximum Marks : 100

Read the following instructions carefully.

1. This question paper contains **16** printed pages including 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 **Optical Response Sheet (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. **Each question has only one 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 60 questions carrying 100 marks. Questions 1 through 20 are 1-mark questions, questions 21 through 60 are 2-mark questions.
7. Questions 51 through 56 (3 pairs) are common data questions and question pairs (57, 58) and (59, 60) are linked answer questions. The answer to the second question of the above 2 pairs 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.
8. Un-attempted questions will carry zero marks.
9. Wrong answers will carry **NEGATIVE** marks. For Q.1 to Q.20, $\frac{1}{3}$ mark will be deducted for each wrong answer. For Q. 21 to Q. 56, $\frac{2}{3}$ mark will be deducted for each wrong answer. The question pairs (Q.57, Q.58), and (Q.59, Q.60) 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.57 and Q.59, $\frac{2}{3}$ mark will be deducted for each wrong answer. There is no negative marking for Q.58 and Q.60.
10. Calculator (without data connectivity) is allowed in the examination hall.
11. Charts, graph sheets or tables are **NOT** allowed in the examination hall.
12. Rough work can be done on the question paper itself. Additionally, blank pages are given at the end of the question paper for rough work.

Q. 1 – Q. 20 carry one mark each.

Q.1 Jute, flax and ramie belong to the family of

- (A) Hair fibres (B) Bast fibres
(C) Leaf fibres (D) Fruit fibres

Q.2 The moisture regain (%) of nylon fibre is in the range

- (A) 2.0 – 3.0 (B) 3.5 – 4.5
(C) 5.0 – 6.0 (D) 6.5 – 7.5

Q.3 The density of polyester fibre is

- (A) More than that of cotton
(B) More than that of nylon but less than that of cotton
(C) Same as that of nylon
(D) More than that of polypropylene but less than that of nylon

Q.4 The group of fibres produced by solution spinning is

- (A) Viscose and polyamide (B) Viscose and acrylic
(C) Polyester and acrylic (D) Polyamide and acetate

Q.5 The maximum practical limit of spindle speed in a commercial cotton ring frame is around

- (A) 5000 rpm (B) 10000 rpm
(C) 20000 rpm (D) 30000 rpm

Q.6 Ring spun cotton yarns of 30, 40, 50 and 60 tex are made from the same fibre. All these yarns are spun with a constant twist per cm of 10. The yarns can be arranged in descending order of helix angle of surface fibres as

- (A) 30, 60, 50, 40 (B) 40, 60, 50, 30
(C) 30, 40, 50, 60 (D) 60, 50, 40, 30

Q.7 Hairiness of ring spun yarn increases, when

- (A) Traveller weight increases
(B) Front zone draft at ring frame increases
(C) Spindle speed decreases
(D) Ring rail speed increases

- Q.8 Surface speed of cone in relation to surface speed of winding drum is
- (A) Equal at all points
 (B) Higher at all points
 (C) Lower at all points
 (D) Higher at some points and lower at other points
- Q.9 Size is primarily applied on warp yarns to
- (A) Increase yarn uniformity
 (B) Increase yarn elongation
 (C) Increase yarn modulus
 (D) Provide protective coating against abrasion
- Q.10 Sley velocity in m/sec at the front centre of a loom running at 300 rpm is
- (A) 0
 (B) 15
 (C) 30
 (D) 45
- Q.11 Desizing of a grey cotton fabric having starch based size can not be done using
- (A) Amylase enzyme
 (B) dilute HCl
 (C) Hydrogen peroxide
 (D) DMDHEU
- Q.12 A wool/acrylic blended fabric can be dyed to solid shade using a combination of
- (A) Direct and acid dyes
 (B) Vat and acid dyes
 (C) Acid and basic dyes
 (D) Reactive and direct dyes
- Q.13 The following dye will be suitable for sublimation transfer printing of polyester
- (A) Reactive dye
 (B) Vat dye
 (C) Acid dye
 (D) Disperse dye
- Q.14 Nep setting on evenness tester is related to the percent mass deviation based on yarn length of
- (A) 10 mm
 (B) 8 mm
 (C) 4 mm
 (D) 1 mm
- Q.15 Uniformity ratio for normal variety of cotton is in the range
- (A) 0.2 - 0.3
 (B) 0.4 - 0.5
 (C) 0.7 - 0.8
 (D) 9.0 - 1.0

Q.16 With increasing twist, spun yarn strength

- (A) Increases continuously
- (B) Decreases continuously
- (C) Decreases initially and then increases
- (D) Increases initially and then decreases

Q.17 The value of breaking length in km (RKM) of a yarn is numerically equal to

- (A) Tenacity in N/tex
- (B) Breaking load in N
- (C) Tenacity in gf/tex
- (D) Breaking load in gf

Q.18 The coefficient of $\cos 4x$ in the Fourier Series of the function

$$f(x) = \begin{cases} -1, & \text{when } -\pi < x < 0 \\ 1, & \text{when } 0 < x < \pi \end{cases} \text{ and } f(x) = f(x + 2\pi), \text{ for all } x \text{ is}$$

- (A) 0
- (B) 1
- (C) -1
- (D) π

Q.19 The partial differential equation

$$\frac{\partial^2 u}{\partial r^2} + \frac{1}{r} \frac{\partial u}{\partial r} + \frac{1}{r^2} \frac{\partial^2 u}{\partial \theta^2} = 0 \text{ is known as the polar form of}$$

- (A) Laplace's equation
- (B) Heat equation
- (C) Wave equation
- (D) None of these

Q.20 Probability of getting 16 in one throw with 3 dice is

- (A) $\frac{1}{8}$
- (B) $\frac{3}{16}$
- (C) $\frac{1}{36}$
- (D) $\frac{1}{108}$

Q. 21 to Q. 60 carry two marks each.

Q.21 Radius of the circle passing through $P(2, 4)$ and the points of intersection with the x -axis of the tangent and normal drawn at P to the curve $y^2 = 8x$ is

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

Q.22 If the determinant and trace of a 2×2 matrix M are -1 and 0 respectively, then the determinant of $M + M^{-1}$ is

- (A) -4 (B) -2 (C) -1 (D) 0

Q.23 If S is the largest possible set of real numbers x for which the series

$\sum_{n=1}^{\infty} \frac{x^n}{n}$ is convergent, then S is

- (A) $(-1, 1)$ (B) $[-1, 1)$ (C) $[-1, 1]$ (D) $(-\infty, \infty)$

Q.24 If the Laplace transform of a function

$f(t)$ is $\frac{1}{s^3 - s}$, then $f(t)$ is

- (A) $\cosh t - 1$ (B) $\cosh t + 1$ (C) $\sinh t - 1$ (D) $\sinh t + 1$

Q.25 The general solution of the differential equation

$x^2 \frac{d^2y}{dx^2} + 2x \frac{dy}{dx} - \frac{y}{x^2} = 0$ is

(A) $y = c_1 \cos x + c_2 \sin x$

(B) $y = c_1 e^x + c_2 e^{-x}$

(C) $y = \left(c_1 + \frac{c_2}{x} \right) e^{(1/x)}$

(D) $y = (c_1 + c_2 x) e^x$

Q.26 The absolute value of the directional derivative of the surface given by

$\frac{x^2}{1} + \frac{y^2}{4} + \frac{z^2}{9} = 3$ at $P(1, 2, 3)$ in the direction of the line OP , where O denotes the origin, is

(A) $\frac{3}{\sqrt{14}}$

(B) $\frac{\sqrt{14}}{3}$

(C) $\frac{6}{\sqrt{14}}$

(D) $\frac{\sqrt{14}}{6}$

Q.27 Consider the fibres in Group I and the corresponding monomer(s) in Group II. Choose the correct combinations from amongst A, B, C and D.

Group I

Group II

P. Polyester (PET)

1. $\text{CH}_2=\text{CH.CN}$, $\text{CH}_2=\text{CH.COOCH}_3$

Q. Nylon 6

2. $\text{HO}-(\text{CH}_2)_2-\text{OH}$, $\text{HOOC}-\text{C}_6\text{H}_4-\text{COOH}$

R. Nylon 6,6

3. $\text{HOOC}-(\text{CH}_2)_6-\text{COOH}$, $\text{H}_2\text{N}-(\text{CH}_2)_6-\text{NH}_2$

S. Acrylic

4. $\text{HO}-(\text{CH}_2)_4-\text{OH}$, $\text{HOOC}-\text{C}_6\text{H}_4-\text{COOH}$

5. $\text{HOOC}-(\text{CH}_2)_4-\text{COOH}$, $\text{H}_2\text{N}-(\text{CH}_2)_6-\text{NH}_2$

6. $\text{H}_2\text{N}-(\text{CH}_2)_5-\text{COOH}$

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

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

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

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

Q.28 With increase in relative humidity from 0 to 100%, the tensile properties of cotton fibre change such that

(A) Modulus and strength increase, extensibility decreases

(B) Modulus decreases, strength and extensibility increase

(C) Modulus and strength decrease, extensibility remains same

(D) Modulus and strength decrease, extensibility increases

Q.29 On drawing and heat setting, the properties of synthetic fibres change such that

(A) Modulus and tenacity increase, extensibility decreases

(B) Modulus increases, tenacity and extensibility decrease

(C) Modulus, tenacity as well as extensibility increase

(D) Modulus and tenacity increase, extensibility remains same

- Q.30 Consider the fibre characterization techniques in Group I used to test the physical properties in Group II. Choose the correct combinations from amongst A, B, C and D.

Group I

- P. Thermogravimetry (TGA)
 Q. Differential Scanning Calorimetry (DSC)
 R. X-Ray Diffraction
 S. Polarizing Optical Microscopy

Group II

1. Birefringence
 2. Crystallinity
 3. Degradation temperature
 4. Melting and crystallisation temperature

- (A) P-4, Q-3, R-2, S-1 (B) P-3, Q-2, R-1, S-4
 (C) P-3, Q-4, R-2, S-1 (D) P-3, Q-4, R-1, S-2

- Q.31 Consider the following elements in Group I and Group II and choose the correct alternative from amongst A, B, C and D.

Group I

- P. Licker-in
 Q. Cylinder
 R. Flats
 S. Doffer

Group II

1. High speed, fine wires
 2. Fibre rupture, coarse wires
 3. Wires with acute front angle, condensing of fibre
 4. Slow speed, stripping action
 5. Nep removal, slowest speed

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

- Q.32 Pressure field from the nip of drafting roller can be extended by

- (A) Reducing roller pressure and increasing hardness of top roller
 (B) Reducing mass of fibre stands and reducing roller diameter
 (C) Increasing roller diameter and increasing roller pressure
 (D) Increasing width of fibre strand and increasing hardness of top roller

- Q.33 The packing coefficient of a yarn with 100 fibres is increased by 10%, the percentage change in yarn diameter will be approximately

- (A) -16.9 (B) -10.9
 (C) -4.9 (D) 4.9

Q.34 Consider the following elements in Group I and Group II and choose the correct alternative from amongst A, B, C and D.

Group I

- P. Wrap spinning
- Q. Air-jet spinning
- R. Friction Spinning
- S. Rotor spinning

Group II

- 1. Core sheath structure, high production rate
- 2. Wrapper fibre belts and commonly used for denim
- 3. Mostly used for man-made fibres, stiffer yarns
- 4. Composite yarn, low production rate
- 5. Versatile in range of fibres and yarn counts

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

Q.35 A blowroom is having five machines. The total cleaning efficiency for first four machines is 40%. The cleaning efficiency of the last machine is 30%. The overall cleaning efficiency (%) of the blowroom is

- (A) 70
- (B) 64
- (C) 58
- (D) 52

Q.36 For increasing the taper angle on a sectional warping machine, one would require to

- (A) Increase the traverse speed
- (B) Decrease the traverse speed
- (C) Increase the warping speed
- (D) Decrease the warping speed

Q.37 A fabric having 30 tex warp and 20 tex weft with 40 ends/cm and 30 picks/cm has 10% crimp in both warp and weft yarns. The fabric weight in g/m^2 will be

- (A) 178
- (B) 188
- (C) 198
- (D) 208

Q.38 A 180 cm wide fabric with 30 picks/cm is produced on a loom running at 500 rpm with 95% efficiency. The number of metres of fabric produced per hour will be

- (A) 9.0
- (B) 9.5
- (C) 10.0
- (D) 10.5

- Q.39 Restarting a loom after the overnight stoppage will have
- Higher than set pick spacing at start
 - Lower than set pick spacing at start
 - Same as set pick spacing at start
 - Sometimes higher but mostly lower pick spacing than set pick spacing at start
- Q.40 In fully relaxed state the loop shape factor (defined as a ratio of courses per unit length to wales per unit length) of a plain weft knitted cotton fabric will be approximately
- 0.3
 - 0.8
 - 1.3
 - 1.8

- Q.41 Consider the elements in Group I and Group II and choose the correct alternative from amongst A, B, C and D.

Group I

- Resin finishing
- Carrier
- Biopolishing
- Discharge printing

Group II

- Polyester dyeing
- Cellulase
- DMDHEU
- Hydrogen peroxide
- Pectinase
- Sodium sulphonylate formaldehyde

- P-3, Q-1, R-2, S-6
- P-6, Q-1, R-4, S-3
- P-3, Q-6, R-1, S-5
- P-3, Q-6, R-4, S-1

- Q.42 Consider the following statements :

- Presence of iron and copper ions during bleaching with sodium chlorite is desirable.
- Sodium silicate is used as a stabilizer in bleaching of cotton with hydrogen peroxide.
- Oil repellent finishes are based on fluorochemicals.
- Sodium hydrosulphite is used as a reducing agent in vat printing.

Choose the correct set of statements from amongst the alternatives A, B, C and D.

- P, S
- Q, S
- P, R
- Q, R

- Q.43 Saponification with sodium hydroxide is done to increase the soil release property of

- Polyester
- Cotton
- Wool
- Jute

- Q.44 The highest rate of production in printing is obtained on
- (A) Flat bed printing (B) Block printing
(C) Digital printing (D) Rotary screen printing
- Q.45 The optimum conditions for bleaching cotton with hydrogen peroxide are
- (A) pH 7, 60°C (B) pH 7, boil
(C) pH 10, 60°C (D) pH 10, boil
- Q.46 Length of 2 kg of 180 denier polyester yarn is
- (A) 90 km (B) 100 km
(C) 180 km (D) 360 km
- Q.47 Consider the instruments of Kawabata Evaluation System in Group I and the properties measured in Group II and choose the correct alternatives from amongst A, B, C and D.

Group I	Group II
P. KES-FB1	1. Compression
Q. KES-FB2	2. Abrasion
R. KES-FB3	3. Hygral expansion
S. KES-FB4	4. Bending
	5. Surface friction
	6. Shear
(A) P-6, Q-4, R-1, S-5	(B) P-3, Q-1, R-4, S-5
(C) P-6, Q-2, R-4, S-3	(D) P-4, Q-2, R-1, S-3

- Q.48 Projected area of a 30 cm diameter fabric specimen placed on 20 cm diameter support plate of drape tester is 302 cm². Drape coefficient for this fabric is approximately
- (A) 0.47 (B) 0.57 (C) 0.67 (D) 0.77

Q.49 99% confidence range of the mean yarn strength based on 64 test samples is ± 8 . The number of test samples required to obtain 99% confidence range of ± 4 of the yarn strength will be

- (A) 64 (B) 128 (C) 256 (D) 512

Q.50 The tear resistance of woven fabric increases with

- (P) Increase in yarn to yarn friction
 (Q) Increase in yarn strength
 (R) Increase in thread spacing
 (S) Increase in float length

Choose the correct combinations from amongst the alternatives A, B, C and D.

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

Common Data Questions

Common Data for Questions 51 and 52:

The feed rate of a card is 100 kg/hour and the delivery rate is 400 m/min. Licker-in droppings and flat strips are 3% and 1% respectively.

Q.51 The count of card sliver (Ne) will be approximately

- (A) 0.16 (B) 0.15 (C) 0.14 (D) 0.13

Q.52 If the total draft in the card is decreased by 10%, the sliver linear density in ktex will be

- (A) 6.4 (B) 5.4 (C) 4.4 (D) 3.4

Common Data for Questions 53 and 54:

Assume Peirce's Geometry and circular yarn of 0.5 mm diameter. A square plain woven fabric with maximum sett would have

Q.53 Thread spacing (mm) in the fabric as

- (A) 0.433 (B) 0.500 (C) 0.866 (D) 1.000

Q.54 Approximate crimp (%) in warp and weft yarns as

- (A) 6 (B) 11 (C) 16 (D) 21

Common Data for Questions 55 and 56:

Ten thousand metre of polyester fabric is to be dyed to 2% depth of shade by continuous method. The width of the fabric is 1.5 m and mass per unit area is 200 g/m^2 . Assume the specific gravity of the dye liquor to be 1.0 and a wet pickup of 80% after padding.

Q.55 The volume of the liquor in litres used on the fabric would be

- (A) 2000 (B) 2400 (C) 2800 (D) 3200

Q.56 The concentration (gpl) of the dye bath would be

- (A) 40 (B) 35 (C) 30 (D) 25

Linked Answer Questions**Linked Answer Questions 57 and 58:**

Q.57 The relationship between percent moisture regain (R) and percent moisture content (M) is

(A) $M = \frac{R}{1 + (R/100)}$

(B) $M = \frac{R}{1 + R}$

(C) $R = \frac{M}{1 + (M/100)}$

(D) $M = \frac{1 + R}{100R}$

Q.58 If the percent moisture regain (R) of a fibre is 8, its percent moisture content (M) would be approximately

- (A) 7.4 (B) 7.2 (C) 7.6 (D) 7.0

Linked Answer Questions 59 and 60:

Q.59 Two roving with a CV of 8% each are fed into a spinning zone and if the spinning unit adds 8% CV, the CV% of output yarn will be approximately

- (A) 8.0 (B) 8.9 (C) 9.8 (D) 12.0

Q.60 The CV% of 3-ply yarn produced using these single yarns will be approximately

- (A) 4.93 (B) 5.66 (C) 6.93 (D) 9.24

END OF THE QUESTION PAPER