TF : TEXTILE ENGINEERING AND FIBRE SCIENCE

ONLINE Examination

Duration: Three Hours *Maximum Marks*: 100

Read the following instructions carefully.

1. Questions must be answered using computers provided by the GATE at the examination centers. Each computer shall run specialized examination software that permits a maximum of one answer to be selected for questions of multiple choice type.
2. Your answers shall be updated and saved on the server periodically and at the end of the examination. The examination will automatically stop once the duration of the examination is over.
3. There are a total of **65** questions carrying 100 marks. All questions are of objective type.
4. Questions Q.1 – Q.25 carry 1-mark each, and questions Q.26 – Q.55 carry 2-marks each.
5. Questions Q.26 - Q.30 are of numerical answer type. For each of these questions, the correct answer is a number. All other questions are of multiple choice type. Each of these questions carries four choices for the answer labeled A, B, C and D. Only one of the four choices is the correct answer.
6. 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 unattempted, then the answer to the second question in the pair will not be evaluated.
7. Questions Q.56 – Q.65 belong to General Aptitude (GA). Questions Q.56 – Q.60 carry 1-mark each, and questions Q.61 – Q.65 carry 2-marks each.
8. Unattempted questions will result in zero mark. There is no negative marking for questions of numerical answer type, i.e., for Q.26 – Q.30. For questions of multiple choice type, wrong answers will result in **NEGATIVE** marks. For Q.1 – Q.25 and Q.56 – Q.60, ⅓ mark will be deducted for each wrong answer. For Q.31 – Q.51 and Q.61 – Q.65, ⅔ 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, ⅔ mark will be deducted for each wrong answer. There is no negative marking for Q.53 and Q.55.
9. Calculator is allowed whereas charts, graph sheets or tables are **NOT** allowed in the examination hall.
10. Rough work can be done in the specified area only.
11. Candidates may use the back side of this page to record their answers for their own convenience.
12. To login, type your Registration Number and password as per instructions provided in the envelope.
13. In order to answer a question, you may select the question using the left side selection panel on the screen and choose the correct answer by clicking on the radio button next to the answer. The answered questions shall be indicated by a solid black ball on the selection panel. In order to change the answer, you may just click on another option. If you wish to leave a previously answered question unanswered, you may click on DESELECT ANSWER button.
14. You may also select questions using NEXT and PREVIOUS buttons.
15. You may also mark questions for reviewing later using MARK button. All marked questions are indicated by a rectangle in the selection panel. Questions which are answered but are marked for the review are indicated by a solid black rectangle and questions which are not answered but are marked for the review are indicated by an outlined rectangle in the selection panel.
16. You must sign this sheet and leave it with the invigilators at the end of the examination.

DECLARATION

I hereby declare that I have read and followed all the instructions given in this sheet.

Paper Code: TF Registration No:_____Name: _____

Signature

Q. 1 – Q. 25 carry one mark each.

Q.1 Density of cotton fibre is approximately

(A) 1.52 denier (B) 1.52 g/tex (C) 1.52 kg/m^3 (D) 1.52 g/cm^3

Q.2 The byproduct obtained from polycondensation of diethylene glycol terephthalate (DGT) is

(A) Glycolic acid
(B) Water
(C) Diethylene glycol
(D) Ethylene glycol

Q.3 Ziegler Natta catalyst is used in the polymerization of

(A) PET
(B) Nylon
(C) Acetate
(D) Polypropylene

Q.4 The cross-section of spinneret used for producing hollow fibres is

(A) C-shaped
(B) Rectangular
(C) Annular concentric
(D) Triangular

Q.5 For a given yarn count made from the same fibre, rotor spun yarn is bulkier than ring spun yarn, because

(A) Rotor spun yarn is more even than ring spun yarn
(B) Navel tube peels off the fibres from rotor spun yarn surface
(C) Rotor spun yarn has large number of wrapper fibres
(D) Yarn tension in rotor spinning is lower as compared to that in ring spinning

Q.6 Consider the statement, 'off-setting the front top drafting roller towards the front is beneficial in a ring spinning machine'. Which one of the following **CANNOT** be the reason for the same?

(A) It reduces the hairiness of yarn
(B) It results in smooth running of top drafting roller
(C) It reduces end breaks
(D) It results in shorter spinning triangle

Q.7 20s, 30s, 40s and 50s Ne cotton yarns have the same twist per cm. The yarn having maximum fibre obliquity is

(A) 20s Ne (B) 30s Ne (C) 40s Ne (D) 50s Ne

Q.8 During roller drafting, better fibre control is achieved by flexing the fibre strand over the bottom roller. The reason for this is

(A) Enhanced fibre to fibre coefficient of friction
(B) Enhanced fiber to fibre friction
(C) Reduced slippage of top roller
(D) Reduced fibre to metal friction

Q.9 For 2/2 twill weave, the heald shaft movement over one complete repeat will be the least in

(A) Bottom closed shed
(B) Semi open shed
(C) Centre closed shed
(D) Open shed

Q.10 In a flat bed knitting machine, the loop length is controlled by

(A) Raising cam
(B) Stitch cam
(C) Clearing cam
(D) Guard cam

Q.11 In a drum driven winder

(A) Traverse ratio is constant
(B) Traverse ratio reduces with the increase in package diameter
(C) Angle of wind increases with the increase in package diameter
(D) Angle of wind reduces with the increase in package diameter

Q.12 The power required for picking in a shuttle loom depends on

(A) Weave of the fabric
(B) Number of heald shafts
(C) Reed width
(D) Number of picking cams

Q.13 Out of the following, the one which is **NOT** a surfactant is

(A) Reducing agent (B) Wetting agent (C) Detergent (D) Dispersing agent

Q.14 The machine used for continuous processing of fabric is

(A) Winch
(B) Kier
(C) J-Box
(D) Jigger

Q.15 An example of a coagulant used in textile effluent treatment is

(A) Activated carbon
(B) Ferrous sulphate
(C) Hydrogen peroxide
(D) Sodium chloride

Q.16 Microbes growing on clothing derive nutrition from

(A) Atmospheric oxygen
(B) Digestion of polymer
(C) Sweat and contaminants
(D) Moisture in the air

Q.17 If the 50 % span length of a cotton fibre is 13.5 mm and the uniformity ratio is 45 %, then 2.5 % span length of this fibre in mm would be

(A) 10 (B) 15 (C) 30 (D) 35

Q.18 The nep setting on an evenness tester which will give the highest nep count is

(A) +400 % (B) +280 % (C) +200 % (D) +140 %

Q.19 Fabrics with the same sett but different weaves are woven on a loom. The tear strength will be minimum in a fabric having

(A) Plain weave (B) 3/1 twill weave (C) 5-end satin weave (D) 2/2 matt weave

Q.20 The property of fabric which influences drape the most is

(A) Tensile
(B) Compressional
(C) Shear
(D) Surface

Q.21 Probability of occurrence of two events E_1 and E_2 is 0.25 and 0.5, respectively. The probability of their simultaneous occurrence is 0.14. The probability that neither E_1 nor E_2 occurs is

(A) 0.11 (B) 0.25 (C) 0.39 (D) 0.86

Q.22 The value of $\lim_{x\to 0} \frac{(1+x)^n - 1}{x}$ is

(A) 0 (B) n (C) ∞ (D) 1/n

Q.23 The area of an ellipse with '*a*' and '*b*' as the length of major and minor axis, respectively, is

(A) πab (B) $\pi\frac{(a+b)}{2}$ (C) $\pi\frac{ab}{4}$ (D) $\pi\frac{ab}{2}$

Q.24 The order and degree of the following differential equation are

$$x\left(\frac{dy}{dx}\right) + \frac{2}{\left(\frac{dy}{dx}\right)} = y^2$$

(A) order 1, degree 1 (B) order 1, degree 2 (C) order 2, degree 1 (D) order 2, degree 2

Q.25 X and Y are two matrices such that XY and X+Y are both defined. The **CORRECT** statement from amongst the following is

(A) X and Y are square matrices of the same order
(B) X is a square matrix whereas Y is a rectangular matrix
(C) X and Y are diagonal matrices of different order
(D) X and Y are rectangular matrices

Q. 26 to Q. 55 carry two marks each.

Questions Q.26 to Q.30 are numeri cal answer type. The answ er to each of these questions is either a positive whole number, or a positive real number with maximum of 3 decimal places.

Q.26 A filament yarn of 300 denier is being spun at a take up speed of 900 m/min. Assuming the density of the melt as 1.2 g/cm^3, the throughput speed (cm^3/min) at the spinneret would be _____

Q.27 The delivery rate of a roving machine is 20 m/min. Assuming the flyer speed as 1000 rpm, inner diameter of the flyer top as 1 cm, diameter of roving as 2.5 mm, and the slippage between the flyer top and roving as 50 %, the false twist (turns/m) in the roving above the flyer is _____

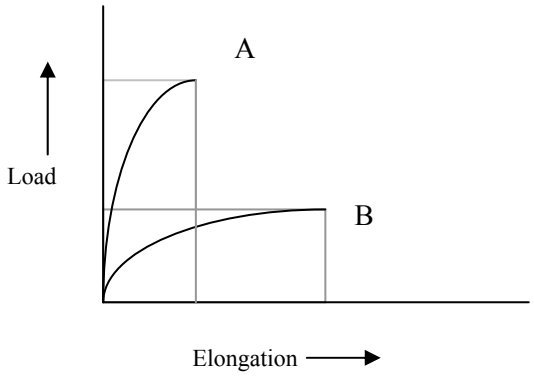
Q.28 For a sizing process, the target add-on (%) and the size paste concentration (%) is 10 and 20, respectively. If the oven dry mass of the supply warp sheet is 100 kg, the mass of water in kg to be evaporated from the warp sheet during drying is _____

Q.29 A garment factory manufactures shirts. From the past history, it is known that 8 out of 100 collars and 5 out of 100 sleeves are defective. The probability that the assembled shirt will **NOT** have either of these defects is _____

Q.30 A yarn has mean strength of 10 N with a standard deviation of 1 N. The number of tests which must be conducted, so that at 95 % confidence level, maximum error in the estimated mean strength is 1.96 %, is _____

Questions Q.31 to Q.55 are multiple choice type.

Q.31 Given below are the load-elongation characteristics of two monofilament yarns A and B having the same denier and the work of rupture. Consider the following assertion **[a]** and reason **[r].**



[a] Fabrics made from these two yarns, with the same weave and sett, will have the same resistance to high impact.
[r] The work of rupture of the two fabrics is the same.

(A) **[a]** is right and **[r]** is wrong
(B) **[a]** is wrong and **[r]** is right
(C) Both **[a]** and **[r]** are right
(D) Both **[a]** and **[r]** are wrong

Q.32 Consider the following assertion **[a]** and reason **[r]** in the case of high bulk yarn.
[a] Acrylic high bulk yarn is a commercial success but not the polypropylene high bulk yarn.
[r] Amorphous orientation can be easily frozen in acrylic fibres but not in polypropylene fibres.

(A) **[a]** is right and **[r]** is wrong
(B) **[a]** is wrong and **[r]** is right
(C) Both **[a]** and **[r]** are right
(D) Both **[a]** and **[r]** are wrong

Q.33 Match the items in **Group I** with those in **Group II**.

	Group I		Group II
P	Crystallinity	**1**	Sonic modulus tester
Q	Surface features	**2**	Infrared spectrophotometer
R	Orientation	**3**	Scanning electron microscope
S	Functional groups	**4**	Differential scanning calorimeter

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

Q.34 Determine the correctness or otherwise of the following assertion **[a]** and reason **[r].**
[a] When the bales are highly compressed, photo cells near the inclined spiked lattice of a Hopper bale opener are set at a lower height.
[r] Position of photo cells controls the mass flow rate of tufts within the Hopper bale opener

(A) **[a]** is right and **[r]** is wrong
(B) **[a]** is wrong and **[r]** is right
(C) Both **[a]** and **[r]** are right
(D) Both **[a]** and **[r]** are wrong

Q.35 The ring rail moves up and down in a cyclic manner during formation of a cop. The combination of events occurring during upward traverse of the ring rail is

P) Traveller speed decreases
Q) Balloon tension decreases
R) More yarn is wound by the traveller
S) Balloon tension increases

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

Q.36 Match the items in **Group I** with those in **Group II**.

	Group I		Group II
P	Ring spinning	**1**	Real twist, mechanical twisting, low fibre migration, aerodynamic drafting
Q	Rotor spinning	**2**	False twist, aerodynamic twisting, low fibre migration, roller drafting
R	Air-vortex spinning	**3**	Real twist, mechanical twisting, high fibre migration, roller drafting
S	Air-jet spinning	**4**	Real twist, aerodynamic twisting, high fibre migration, roller drafting

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

Q.37 For a 5/3 twill weave, if the rotational speeds of the crank shaft, bottom shaft and tappet shaft are X, Y and Z respectively, then X:Y:Z would be

(A) 1:4:8 (B) 8:4:1 (C) 2:1:1 (D) 2:1:8

Q.38 In air-jet weaving, the acceleration of the weft yarn will be maximum when the yarn is

(A) Coarser and more hairy
(B) Coarser and less hairy
(C) Finer and less hairy
(D) Finer and more hairy

Q.39 For a plain woven fabric, the diameters of warp and weft yarns are 0.2 mm and 0.3 mm, respectively. The crimp in warp yarn is 9 % and pick spacing is 0.4 mm. The fabric thickness in mm is

(A) 0.32 (B) 0.50 (C) 0.64 (D) 0.75

Q.40 Match the items in **Group I** with those in **Group II**.

	Group I		**Group II**
P	Sodium formaldehyde sulphoxylate	**1**	Hygroscopic agent
Q	Urea	**2**	Mild oxidizing agent
R	Resist salt	**3**	Thickener
S	Carboxy methyl cellulose (CMC)	**4**	Reducing agent

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

Q.41 Determine the correctness or otherwise of the following assertion **[a]** and the reason **[r].**
[a] Phosphorus and nitrogen based agents act as vapour phase flame retardants for cotton.
[r] Phosphorus yields phosphoric acid and hinders formation of levoglucosan while nitrogen has a synergistic effect.

(A) **[a]** is right and **[r]** is wrong
(B) **[a]** is wrong and **[r]** is right
(C) Both **[a]** and **[r]** are right
(D) Both **[a]** and **[r]** are wrong

Q.42 Match the items in **Group I** with those in **Group II**.

	Group I		**Group II**
P	Crabbing	**1**	Cut and remove projecting fibres
Q	Decatising	**2**	Moisture, heat, mechanical action
R	Milling	**3**	Perforated drum with saturated steam
S	Cropping	**4**	Winding, treatment with hot water

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

Q.43 The coarsest yarn amongst the following is

(A) 100 Ne (B) 50 denier (C) 50 dtex (D) 200 Nm

Q.44 Two cotton fibre varieties X and Y having linear density of 3.1 and 3.9 (micrograms/25.4 mm), respectively, are tested on an airflow instrument. The highest flow rate is obtained in the case of

(A) Fibre X with maturity ratio 0.9
(B) Fibre X with maturity ratio 1.0
(C) Fibre Y with maturity ratio 0.9
(D) Fibre Y with maturity ratio 1.0

Q.45 Warp and weft yarns with diameters of 0.4 mm and 0.6 mm, respectively, are used to produce plain woven fabric with end spacing of 0.8 mm and pick spacing of 1.2 mm. Assuming the degree of flattening to be 0.8 in both warp and weft yarns, the approximate fabric cover would be

(A) 0.56 (B) 0.66 (C) 0.76 (D) 0.86

Q.46 If the error in the measurement of the diameter of a yarn is 0.5 %, the error in the estimated cross-sectional area of this yarn would be

(A) 0.25 % (B) 1.0 % (C) 2.5 % (D) 5.0 %

Q.47 The acceleration (a) of a cotton tuft flowing through a duct in a straight line follows the relationship

$$a = 8 - \frac{t}{5}$$

where acceleration (a) is in cm/s^2 and time (t) is in s. The velocity (cm/s) of the tuft when acceleration is zero is

(A) 160 (B) 180 (C) 200 (D) 220

Common Data Questions

Common Data for Questions 48 and 49:

Consider the following data for a synthetic fibre.
Density of amorphous region (ρ_a) as 1.33 g/cm^3, density of crystalline region (ρ_c) as 1.45 g/cm^3, density of fibre (ρ_f) as 1.36 g/cm^3 and diameter of the fibre as 14 micron.

Q.48 Denier of the fibre is approximately

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

Q.49 Density of the above fibre increased by 2.2 % when drawn. The corresponding change (%) in crystallinity is approximately

(A) 50 (B) 100 (C) 150 (D) 200

Common Data for Questions 50 and 51:

A card with a doffer of diameter 60 cm, fed with a lap of 395 ktex delivers sliver of 3.95 ktex. The draft between the doffer and the coiler calender roller is 1.4.

Q.50 The total draft of the card is

(A) 71 (B) 140 (C) 100 (D) 171

Q.51 If the doffer speed is 50 rpm, the approximate production rate of the card in kg/h would be

(A) 6 (B) 22 (C) 31 (D) 88

Linked Answer Questions

Statement for Linked Answer Questions 52 and 53:
For a shuttle loom, the radius of crank and length of the connecting rod to the sley are 10 cm and 40 cm, respectively.

Q.52 The value of sley eccentricity is

(A) 0.25 (B) 0.50 (C) 1.0 (D) 4.0

Q.53 The ratio of sley acceleration at the front centre and back centre of the loom is

(A) 0.25 (B) – 0.60 (C) – 1.67 (D) 4.0

Statement for Linked Answer Questions 54 and 55:

Four percent add on (owf) of a finish is required on a fabric having a weight of 0.60 kg/m. Consider the wet pick up as 80 %, speed of the fabric as 90 m/min and density of liquor as 1.2 g/ml.

Q.54 Concentration (%) of the finish required in the bath is

(A) 0.2 (B) 3.2 (C) 5.0 (D) 32

Q.55 Finish consumed in kg/min is

(A) 2.16 (B) 2.70 (C) 5.00 (D) 5.40

General Aptitude (GA) Questions

Q. 56 – Q. 60 carry one mark each.

Q.56 Choose the most appropriate word or phrase from the options given below to complete the following sentence.
The environmentalists hope _____ the lake to its pristine condition.

(A) in restoring
(B) in the restoration of
(C) to restore
(D) restoring

Q.57 Choose the word from the options given below that is most nearly opposite in meaning to the given word:
Polemical

(A) imitative
(B) conciliatory
(C) truthful
(D) ideological

Q.58 Choose the most appropriate word from the options given below to complete the following sentence.
Despite the mixture's _____ nature, we found that by lowering its temperature in the laboratory we could dramatically reduce its tendency to vaporize.

(A) acerbic
(B) resilient
(C) volatile
(D) heterogeneous

Q.59 If *m* students require a total of *m* pages of stationery in *m* days, then 100 students will require 100 pages of stationery in

(A) 100 days (B) *m*/100 days (C) 100/*m* days (D) *m* days

Q.60 Choose the most appropriate words from the options given below to complete the following sentence.
Because she had a reputation for _____ we were surprised and pleased when she greeted us so _____.

(A) insolence …… irately
(B) insouciance …… curtly
(C) graciousness …… amiably
(D) querulousness …… affably

Q. 61 to Q. 65 carry two marks each.

Q.61 The number of solutions for the following system of inequalities is

$X_1 \geq 0$
$X_2 \geq 0$
$X_1 + X_2 \leq 10$
$2X_1 + 2X_2 \geq 22$

(A) 0 (B) infinite (C) 1 (D) 2

Q.62 In a class of 300 students in an M.Tech programme, each student is required to take at least one subject from the following three:

M600: Advanced Engineering Mathematics
C600: Computational Methods for Engineers
E600: Experimental Techniques for Engineers

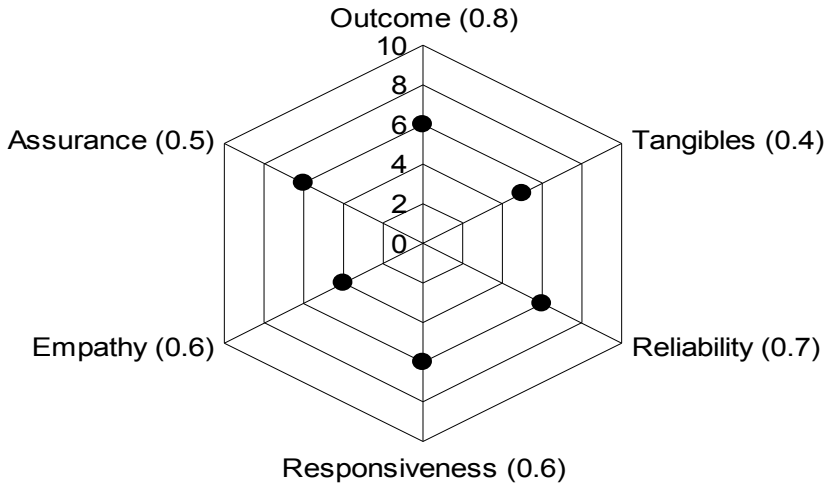
The registration data for the M.Tech class shows that 100 students have taken M600, 200 students have taken C600, and 60 students have taken E600. What is the maximum possible number of students in the class who have taken all the above three subjects?

(A) 20 (B) 30 (C) 40 (D) 50

Q.63 Three sisters (R, S, and T) received a total of 24 toys during Christmas. The toys were initially divided among them in a certain proportion. Subsequently, R gave some toys to S which doubled the share of S. Then S in turn gave some of her toys to T, which doubled T's share. Next, some of T's toys were given to R, which doubled the number of toys that R currently had. As a result of all such exchanges, the three sisters were left with equal number of toys. How many toys did R have originally?

(A) 8 (B) 9 (C) 11 (D) 12

Q.64 The quality of services delivered by a company consists of six factors as shown below in the radar diagram. The dots in the figure indicate the score for each factor on a scale of 0 to 10. The standardized coefficient for each factor is given in the parentheses. The contribution of each factor to the overall service quality is directly proportional to the factor score and its standardized coefficient.



The lowest contribution among all the above factors to the overall quality of services delivered by the company is

(A) 10% (B) 20% (C) 24% (D) 40%

Q.65 **In order to develop to full potential, a baby needs to be physically able to respond to the environment.**

It can be inferred from the passage that

(A) Full physical potential is needed in order for a baby to be able to respond to the environment.
(B) It is necessary for a baby to be able to physically respond to the environment for it to develop its full potential.
(C) Response to the environment of physically able babies needs to be developed to its full potential.
(D) A physically able baby needs to develop its full potential in order to respond to its environment.

END OF THE QUESTION PAPER