GATE 2012 Online Examination
TF : TEXTILE ENGINEERING AND FIBRE SCIENCE

Duration: Three Hours *Maximum Marks*: 100

Read the following instructions carefully.

1. The computer allotted to you at the examination center runs a specialized software that permits only one answer to be selected for multiple choice questions using a mouse. Your answers shall be updated and saved on a server periodically and at the end of the examination.
2. To login, enter your Registration Number and password provided in the envelope. Go through the symbols used in the test and understand the meaning before you start the examination. You can view all questions by clicking on the View All Questions button in the screen after the start of the examination.
3. To answer a question, select the question using the selection panel on the screen and choose the correct answer by clicking on the radio button next to the answer. To change the answer, just click on another option. If you wish to leave a previously answered question unanswered, click on the button next to the selected option.
4. The examination will automatically stop at the end of 3 hours.
5. There are a total of 65 questions carrying 100 marks. Except questions Q.26 – Q.30, all the other questions are of multiple choice type with only **one** correct answer. Questions Q.26 - Q.30 require a numerical answer, and a number should be entered using the virtual keyboard on the monitor.
6. Questions Q.1 – Q.25 carry 1 mark each. Questions Q.26 – Q.55 carry 2 marks each. The 2 marks questions include two pairs of common data questions and two pairs of 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) section and carry a total of 15 marks. 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 and wrong answers will result in **NEGATIVE** marks. There is no negative marking for questions of numerical answer type, i.e., for Q.26 – Q.30. For all 1 mark questions, 1/3 mark will be deducted for each wrong answer. For all 2 marks questions, 2/3 mark will be deducted for each wrong answer. However, in the case of the linked answer question pair, there will be negative marks only for wrong answer to the first question and no negative marks for wrong answer to the second question.
9. Calculator is allowed. Charts, graph sheets or tables are **NOT** allowed in the examination hall. Do the rough work in the Scribble Pad provided.
10. 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.

Registration Number	**TF**							
Name								
Signature								

Verified that the above entries are correct. Invigilator's signature:	

Q. 1 – Q. 25 carry one mark each.

Q.1 The fibre which has a mineral origin is

(A) Asbestos (B) Silk (C) Flax (D) Acrylic

Q.2 The chemical that is used to convert soda cellulose to sodium cellulose xanthate in the manufacture of viscose rayon is

(A) Carbon disulphide
(B) Sodium xanthate
(C) Sodium sulphide
(D) Sodium hydroxide

Q.3 The fibre that will float on water is

(A) Nylon (B) Polyester (C) Acrylic (D) Polypropylene

Q.4 The range of spinning speed (m/min) used in the manufacture of partially oriented polyester yarn is

(A) 1000 – 1200
(B) 2000 – 2500
(C) 2800 – 3500
(D) 4000 – 6000

Q.5 Drawing of synthetic filament **does not** lead to an increase in

(A) Crystallinity
(B) Tenacity
(C) Tensile modulus
(D) Elongation at break

Q.6 In a card, the wire point density is maximum on

(A) Cylinder (B) Flat (C) Doffer (D) Licker-in

Q.7 The spinning system that **does not** generate false twist during spinning is

(A) Ring spinning (B) DREF 3 (C) Rotor spinning (D) Air jet spinning

Q.8 Most of the seed coat particles are removed in

(A) Blow room (B) Card (C) Comber (D) Draw frame

Q.9 An eccentric top roller in a drafting system leads to

(A) Change in draft with oscillation of nip line
(B) Change in draft without oscillation of nip line
(C) Neither change in draft nor oscillation of nip line
(D) Oscillation of nip line only

Q.10 The increase in traveller weight leads to an increase in

(A) Yarn twist
(B) Traveller lag
(C) Balloon diameter
(D) Yarn tension

Q.11 Dog knot is preferred to weaver's knot during creeling because it is

(A) Easier to make
(B) Stronger
(C) Smaller in size
(D) Less prone to slippage

Q.12 Size add-on **does not** depend on

(A) Roller hardness
(B) Drying cylinder temperature
(C) Size paste concentration
(D) Machine speed

Q.13 Ball warping is mainly used in the manufacture of

(A) Terry towel
(B) Narrow fabric
(C) Denim
(D) 3D fabric

Q.14 The factor that **does not** influence the propelling force for moving the weft yarn on air jet loom is

(A) Coefficient of friction between air and yarn
(B) Air velocity
(C) Yarn strength
(D) Yarn diameter

Q.15 In the context of thermal bonding of nonwoven web, the statement which is **not** true is

(A) A thermoplastic component has to be present in the web
(B) Heat is applied until the thermoplastic component melts
(C) The polymer flows by surface tension and capillary action to fibre cross over points
(D) Chemical reaction takes place

Q.16 A 51 mm long fibre has 6 % crimp. The crimped length of the fibre in mm is approximately

(A) 44 (B) 46 (C) 48 (D) 50

Q.17 On a mass based evenness tester, thin place in a yarn at –40 % setting is counted if mass per unit length is

(A) 40 % of the mean mass per unit length
(B) 60 % of the mean mass per unit length
(C) 40 % of the mean mass per unit length or less
(D) 60 % of the mean mass per unit length or less

Q.18 Ratio of grab strength to strip strength is the highest when fabric extension (%) is

(A) 0 (B) 5 (C) 10 (D) 15

Q.19 Bursting strength of a woven fabric with the same warp and weft yarns is the highest when the ratio of ends/cm and picks/cm is

(A) 1.1 (B) 1.0 (C) 0.9 (D) 0.8

Q.20 Fabric abrasion resistance **cannot** be assessed by the loss in

(A) Strength (B) Thickness (C) Weight (D) Air permeability

Q.21 Bleached cotton fabric was sent to a laboratory for determination of Copper Number, which is an estimate of the presence of

(A) Hydroxyl groups (B) Carboxyl groups
(C) Reducing groups (D) Oxidizing groups

Q.22 Malachite Green is an important dyestuff. The typical green colour is obtained when the dye molecule is

(A) Nonionic
(B) Cationic
(C) Anionic
(D) Made up of phenyl groups

Q.23 A typical curve between equilibrium dye uptake and dyeing temperature goes through a maximum. After the maximum, the dye uptake decreases because

(A) Kinetic energy increases rapidly
(B) Pressure in the dye bath increases
(C) Saturation value is reached
(D) Dyeing is an exothermic process

Q.24 The efficacy of the wash-n-wear treatment can be estimated by measuring its

(A) Bending length
(B) Tensile strength
(C) Dye uptake
(D) Crease recovery

Q.25 Softener reduces the bending rigidity of fabrics by decreasing

(A) Inter-fibre and inter-yarn friction
(B) Modulus of the fibres
(C) Glass transition temperature of the fibres
(D) Packing coefficient of yarns

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

Questions Q.26 to Q.30 are numerical answer type. The answer to each of these questions is either a positive whole number, or a positive real number with maximum of 2 decimal places.

Q.26 The density of a given polyester filament sample is 1.38 g/cm^3. Consider the density of fully crystalline polyester as 1.455 g/cm^3 and that of fully amorphous polyester as 1.335 g/cm^3. The percent crystallinity of the sample is _____.

Q.27 Cleaning efficiency of the opening roller in a rotor spinning machine, having 56 mm diameter rotor, is 80 %. The yarn breaks when the trash deposition within the rotor groove crosses the threshold of 1 mg/mm. If a sliver with 0.4 % trash is fed at 7.5 g/min, the number of end breaks in 1 hr (to the nearest whole number) is _____.

Q.28 In a projectile weaving machine the projectile travels a total distance of 250 cm at an average velocity of 25 m/s. If the time period during which it is in motion occupies half of the loom cycle, the maximum loom speed in picks per minute is _____.

Q.29 A 225 denier viscose yarn has a breaking strength of 7.5 N. The yarn tenacity in cN/dtex is _____.

Q.30 In an experiment, 1 g each of the mercerized and unmercerized fabric samples are separately treated in 30 ml of 0.25N barium hydroxide solution for the required time. 10 ml of these solutions are drawn and titrated against 0.1N HCl solution. The volumes of HCl consumed at the end of these titrations are *m* for mercerized and *u* for unmercerized cases. If

$$\text{Barium Activity Number (BAN)} = [(b-m)/(b-u)]\times 100,$$

where m=18 ml, u=20 ml and b is the volume of HCl consumed in the blank titration, then the BAN value for the above mercerized sample is _____.

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

Q.31 Consider the following **Assertion [a]** and **Reason [r]**

[a] M is an orthogonal matrix, but not a skew-symmetric matrix.

$$\mathbf{M} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos\theta & -\sin\theta \\ 0 & \sin\theta & \cos\theta \end{bmatrix}$$

[r] Because $\mathbf{M}^{T} = \mathbf{M}^{-1}$ and $\mathbf{M}^{T} \neq -\mathbf{M}$.

Determine the correctness or otherwise of the above **Assertion [a]** and **Reason [r]**

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

Q.32 A beaker contains 50 cc of an aqueous dye solution of concentration c (w/v). 25 cc of this solution is removed and replaced by 25 cc of distilled water. This process is repeated five more times. The final concentration of the solution is

(A) c (B) $c\left(\frac{1}{2}\right)^5$ (C) $c\left(\frac{1}{2}\right)^6$ (D) $c\left(\frac{1}{2}\right)^7$

Q.33 Assume that the rate of evaporation of moisture from a wet fabric during drying process is proportional to the amount of moisture present in the fabric. If 50 % of the moisture is evaporated in the first 5 minutes then the time (min) taken to evaporate 90 % of the moisture is approximately

(A) 9 (B) 17 (C) 22 (D) 33

Q.34 The number of neps in a carded web follows Poisson distribution with a mean of 100 per m^2. The probability that there is no nep in an area of 645 cm^2 is

(A) $e^{-6.45}$ (B) $e^{6.45}$ (C) e^{-645} (D) e^{645}

Q.35 A yarn of 24 mm length has a varying cross-section. The values of the cross-sectional area of yarn (mm^2), measured at equal intervals of 4 mm from one end are

0.09, 0.12, 0.14, 0.15, 0.16, 0.13, 0.11

The volume of yarn (mm^3) estimated by using Simpson's 1/3 rule of numerical integration is

(A) 2.40 (B) 2.80 (C) 3.20 (D) 3.36

Q.36 Match the property from Group I with the characterization technique from Group II.

	Group I		Group II
P	Spherulite size	1	Optical microscopy
Q	Degradation temperature	2	X-ray diffraction
R	Crystalline orientation	3	Differential scanning calorimetry
S	Melting temperature	4	Thermogravimetric analysis

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

Q.37 Consider the following **Assertion [a]** and R**eason [r]**

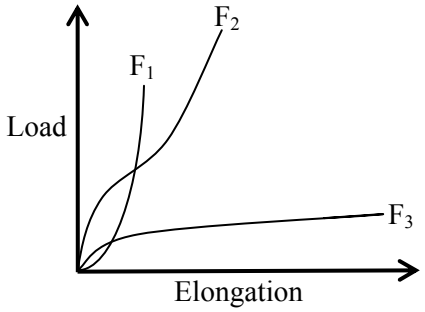
[a] In the case of manufactured fibre spinning, a circular spinneret orifice always results in circular cross-section of filaments in melt spinning, but the same is not true in dry spinning.

[r] Melt spinning involves only heat transfer, whereas dry spinning involves heat as well as mass transfer.

Determine the correctness or otherwise of the above **Assertion [a]** and **Reason [r]**

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

Q.38 Consider the following **assertion [a]** and **reason [r]** in the context of the load-elongation curves of fibres F_1, F_2, and F_3



[a] Fibre F_3 is the most suitable fibre for making a rope for mountaineering.

[r] Mountaineering rope should have high tenacity, high modulus and high work of rupture.

Determine the correctness or otherwise of the above **Assertion [a]** and **Reason [r]**

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

Q.39 The winding speed (difference between bobbin speed and traveller speed) of yarn in a ring frame is 200 rev/min when bobbin diameter is 28 mm. If the bobbin diameter is increased to 35 mm, the winding speed (rev/min) would be

(A) 140 (B) 160 (C) 180 (D) 200

Q.40 The weight of material on a roving bobbin is 2.4 kg. The roving hank is 600 tex. If delivery rate is 20 m/min, the time (min) required to build the bobbin is

(A) 180 (B) 190 (C) 200 (D) 210

Q.41 The terry towel fabric is a

(A) Warp pile structure with two series of warp and one series of weft yarn
(B) Weft pile structure with two series of warp and one series of weft yarn
(C) Warp pile structure with two series of weft and one series of warp yarn
(D) Weft pile structure with two series of weft and one series of warp yarn

Q.42 Sizing of single cotton yarn leads to an increase in

(A) Strength and extensibility but decrease in bending rigidity and hairiness
(B) Strength and bending rigidity but decrease in extensibility and hairiness
(C) Strength and hairiness but decrease in extensibility and bending rigidity
(D) Bending rigidity and extensibility but decrease in strength and hairiness

Q.43 The strength utilization of yarn in a woven fabric is

(A) Always more than 1.0 (B) Always less than 1.0
(C) Always equal to 1.0 (D) Either more or less than 1.0

Q.44 Yarns Y_1 and Y_2 have the same strength when tested at 200 mm gauge length. If mass unevenness CV (%) of yarns Y_1 and Y_2 are 10 and 20 respectively, the ratio of the strength of yarns Y_1 and Y_2 when tested at 500 mm gauge length is

(A) More than 1.0 (B) Less than 1.0
(C) Equal to 1.0 (D) Either more or less than 1.0

Q.45 Consider the following **Assertion [a]** and **Reason [r]**

[a] In the case of dyeing of cotton with reactive dyes, formation of hydrolyzed dye is a major problem.

[r] In an alkaline medium, the reactive dye reacts with the hydroxyl groups irrespective of whether these are from cellulose or water.

Determine the correctness or otherwise of the above **Assertion [a]** and **Reason [r]**

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

Q.46 Consider the following **Assertion [a]** and **Reason [r]**

[a] In the case of durable press finishing of cotton fabrics, while the citric acid can be used as a crosslinking agent, oxalic acid cannot be.

[r] The mechanism of crosslinking requires formation of anhydride in the intermediate step.

Determine the correctness or otherwise of the above **Assertion [a]** and **Reason [r]**

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

Q.47 Consider the following A**ssertion [a]** and **Reason [r]**

[a] In the case of minimum application technique, compared to the conventional rolls of a typical padding mangle, Roberto rolls substantially reduce the wet pick up.

[r] The Roberto rolls are connected to vacuum pump to facilitate removal of liquor from the fabric.

Determine the correctness or otherwise of the above **Assertion [a]** and **Reason [r]**

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

Common Data Questions

Common Data for Questions 48 and 49:

Four polyester and four cotton carded slivers of the same count and mass CV of 4.16 % are drawn together keeping a draft of 8 on a breaker drawframe. Two slivers from breaker drawframe are further drawn along with the four cotton carded slivers keeping a draft of 6 on a finisher drawframe.

Q.48 The polyester (%) in the final sliver is approximately

(A) 8 (B) 17 (C) 25 (D) 33

Q.49 The mass CV (%) of the final sliver is approximately

(A) 0.6 (B) 1.24 (C) 1.86 (D) 2.33

Common Data for Questions 50 and 51:

A fabric is woven from 38 tex yarns of 0.65 packing coefficient and 1.54 g/cm^3 fibre density. The fabric has 30 ends per cm and 25 picks per cm. Assume that warp is jammed.

Q.50 The weft crimp (%) is approximately

(A) 0 (B) 5 (C) 10 (D) 15

Q.51 The thickness of the above fabric (mm) is approximately

(A) 0.05 (B) 0.25 (C) 0.50 (D) 0.75

Linked Answer Questions

Linked Answer Questions 52 and 53:

The thermal conductivity of a nonwoven fabric is given by

$$\lambda = 0.03 + 0.00005\rho + \frac{0.15}{\rho}$$

where λ is the thermal conductivity of the fabric in W/(m·K), ρ is the bulk density of the fabric in kg/m^3, and $\rho \in [10, 200]$.

Q.52 Thermal conductivity is minimum when the bulk density is approximately

(A) 10 (B) 20 (C) 55 (D) 200

Q.53 The minimum value of thermal conductivity, in mW/(m·K), is approximately

(A) 36 (B) 39 (C) 41 (D) 46

Linked Answer Questions 54 and 55:

A cotton fibre of 180 millitex has a density of 1.5 g/cm^3 and an average perimeter of 40 μm.

Q.54 The average area of the cell wall (μm^2) is

(A) 80 (B) 100 (C) 120 (D) 140

Q.55 The average degree of thickening of cell wall is approximately

(A) 0.84 (B) 0.89 (C) 0.94 (D) 0.99

General Aptitude (GA) Questions

Q. 56 – Q. 60 carry one mark each.

Q.56 Which one of the following options is the closest in meaning to the word given below?

Pacify

(A) Excite (B) Soothe (C) Deplete (D) Tire

Q.57 Choose the most appropriate pair of words from the options given below to complete the following sentence:

The high level of ___ of the questions in the test was ___ by an increase in the period of time allotted for answering them.

(A) difficulty, compensated
(B) exactitude, magnified
(C) aptitude, decreased
(D) attitude, mitigated

Q.58 Choose the grammatically **CORRECT** sentence:

(A) He laid in bed till 8 o'clock in the morning.
(B) He layed in bed till 8 o'clock in the morning.
(C) He lain in bed till 8 o'clock in the morning.
(D) He lay in bed till 8 o'clock in the morning.

Q.59 Which one of the parts (A, B, C, D) in the sentence contains an **ERROR**?

No sooner had the doctor seen the results of the blood test, than he suggested the patient to see the specialist.

(A) no sooner had
(B) results of the blood test
(C) suggested the patient
(D) see the specialist

Q.60 Ten teams participate in a tournament. Every team plays each of the other teams twice. The total number of matches to be played is

(A) 20 (B) 45 (C) 60 (D) 90

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

Q.61 A value of x that satisfies the equation $\log x + \log (x - 7) = \log (x + 11) + \log 2$ is

(A) 1 (B) 2 (C) 7 (D) 11

Q.62 Let $f(x) = x - [x]$, where $x \geq 0$ and $[x]$ is the greatest integer not larger than x. Then $f(x)$ is a

(A) monotonically increasing function
(B) monotonically decreasing function
(C) linearly increasing function between two integers
(D) linearly decreasing function between two integers

Q.63 Ravi is taller than Arun but shorter than Iqbal. Sam is shorter than Ravi. Mohan is shorter than Arun. Balu is taller than Mohan and Sam. The tallest person can be

(A) Mohan (B) Ravi (C) Balu (D) Arun

Q.64 A smuggler has 10 capsules in which five are filled with narcotic drugs and the rest contain the original medicine. All the 10 capsules are mixed in a single box, from which the customs officials picked two capsules at random and tested for the presence of narcotic drugs. The probability that the smuggler will be caught is

(A) 0.50 (B) 0.67 (C) 0.78 (D) 0.82

Q.65 **The documents expose the cynicism of the government officials – and yet as the media website reflects, not a single newspaper has reported on their existence.**

Which one of the following inferences may be drawn with the greatest accuracy from the above passage?

(A) Nobody other than the government officials knew about the existence of the documents.
(B) Newspapers did report about the documents but nobody cared.
(C) Media reports did not show the existence of the documents.
(D) The documents reveal the attitude of the government officials.

END OF THE QUESTION PAPER