TF: TEXTILE ENGINEERING AND FIBRE SCIENCE

Duration: Three Hours *Maximum Marks*: 150

Read the following instructions carefully

1. This question paper contains **20** 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 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 the questions in this question paper are of objective type.

5. Questions must be answered on **O**bjective **R**esponse **S**heet (**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 a wrong answer.

6. Questions 1 through 20 are 1-mark questions and questions 21 through 85 are 2-mark questions.

7. Questions 71 through 73 is one set of common data questions, questions 74 and 75 is another pair of common data questions. The question pairs (76, 77), (78, 79), (80, 81), (82, 83) and (84, 85) are questions with linked answers. The answer to the second question of the above pairs will depend 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. **NEGATIVE MARKING**: For Q.1 to Q.20, ***0.25*** mark will be deducted for each wrong answer. For Q.21 to Q.75, ***0.5*** mark will be deducted for each wrong answer. For the pairs of questions with linked answers, there will be negative marks only for wrong answer to the first question, i.e. for Q.76, Q.78, Q.80, Q.82 and Q.84, ***0.5*** mark will be deducted for each wrong answer. There is no negative marking for Q.77, Q.79, Q.81, Q.83 and Q.85.

10. Calculator **without data connectivity** is allowed in the examination hall.

11. Charts, graph sheets and tables are NOT allowed in the examination hall.

12. Rough work can be done on the question paper itself. Additional blank pages are given at the end of the question paper for rough work.

Q. 1 – Q. 20 carry one mark each

Q.1 Consider the following data,

21.0 21.6 19.9 19.6 15.6

The variance of this sample rounded off to third decimal place, is

(A) 25.309 (B) 15.109 (C) 10.209 (D) 5.509

Q.2 $\lim_{x\to 2}\dfrac{x^2-4}{x-2}$ is equal to

(A) -2 (B) 2 (C) 4 (D) ∞

Q.3 The inverse of the matrix $\begin{pmatrix}\cos\theta & -\sin\theta\\ \sin\theta & \cos\theta\end{pmatrix}$ is

(A) $\begin{pmatrix}-\cos\theta & -\sin\theta\\ -\sin\theta & \cos\theta\end{pmatrix}$ (B) $\begin{pmatrix}\cos\theta & \sin\theta\\ -\sin\theta & \cos\theta\end{pmatrix}$

(C) $\begin{pmatrix}\sin\theta & \cos\theta\\ -\sin\theta & -\cos\theta\end{pmatrix}$ (D) $\begin{pmatrix}-\cos\theta & \sin\theta\\ \sin\theta & \cos\theta\end{pmatrix}$

Q.4 The value of the determinant $\begin{vmatrix}3 & 1 & 6\\ 1 & 2 & 2\\ -3 & 3 & -6\end{vmatrix}$ is

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

Q.5 The function $f(x)=x^3-3x+3$ defined in the interval $[-2, 2]$ has a minimum at

(A) $x=-1$ (B) $x=0$ (C) $x=1$ (D) $x=2$

Q.6 The breaking extension of flax, cotton, jute and wool (at 65 % r.h. and 20 °C) in the decreasing order is

(A) Wool > Jute >Cotton >Flax
(B) Wool > Cotton > Jute >Flax
(C) Wool > Jute > Flax > Cotton
(D) Wool > Cotton > Flax > Jute

Q.7 Nylon 6, nylon 66, wool and silk can all be classified as

(A) Polyethers (B) Polyesters
(C) Polyamides (D) Polyolefins

Q.8 Mixing of two polymer melts yields

(A) Block copolymers (B) Random copolymers
(C) Alternate copolymers (D) Polymer blends

Q.9 In the context of application of spin finish to synthetic fibres, the INCORRECT statement among the following is

(A) Spin finish dissipates static charge
(B) Spin finish reduces fibre breakage in carding
(C) Spin finish reduces the stiffness of the fibre
(D) Spin finish reduces nep generation tendency in fibres

Q.10 With the use of heavier traveller

(A) Spinning tension decreases
(B) Yarn elongation increases
(C) Yarn balloon size increases
(D) Yarn hairiness decreases

Q.11 When the doffer of a card fed by chute feed system is stopped

(A) Accelerating flaps close
(B) Separating flaps open
(C) Differential pressure regulator stops working
(D) Exhaust flaps close

Q.12 Sizing of warp yarn

(A) Adds value to warp yarn
(B) Improves weavability
(C) Increases the strength of finished fabric
(D) Increases breaking extension of the sized yarn

Q.13 Air jet texturing makes multifilament yarn more suitable as weft in air jet weaving. Because the yarn becomes

(A) Rigid and does not bend in the shed
(B) Smooth and helps to reduce friction with warp
(C) Bulkier and results in high propelling force
(D) Heavier and produces high kinetic energy

Q.14 Fibres with a rectangular cross-section are preferred over those with trilobal cross-section for mechanically entangled nonwoven fabric, because rectangular cross-section

(A) Provides high packing density of the web
(B) Offers high strength to the web
(C) Gives better hand value to the fabric
(D) Entangles more easily than the trilobal fibre

Q.15 Singeing of cotton fabrics results in

(A) Improved strength
(B) Decreased crease recovery
(C) Increased bending rigidity
(D) Improved performance during printing

Q.16 Souring is done to

(A) Remove size
(B) Neutralize the substrate after alkaline treatment
(C) Remove colourant
(D) Remove Wax

Q.17 The essential step/s in carbonization of wool is / are treatment with

(A) Dilute sulfuric acid and baking
(B) Reducing agent followed by antichlor treatment
(C) Carbon tetrachloride
(D) Activated carbon

Q.18 Uniformity ratio is the ratio of

(A) 50% span length and 2.5% span length
(B) 2.5% span length and 50% span length
(C) Mean length and upper half mean length
(D) Upper half mean length and mean length

Q.19 The characteristics wave form produced by light scattered by individual fibres in an AFIS instrument is

(A) Spiked
(B) Triangular
(C) Rectangular
(D) Elliptical

Q.20 The decreasing order of variation in tensile properties of fibres and corresponding yarns and fabrics is

(A) Fibre, Yarn, Fabric
(B) Yarn, Fabric, Fibre
(C) Fabric, Fibre, Yarn
(D) Yarn, Fibre, Fabric

Q. 21 to Q.75 carry two marks each

Q.21 The total derivative of a function $u = f(x, y, z)$ is expressed as $du = \frac{\partial f}{\partial x}dx + \frac{\partial f}{\partial y}dy + \frac{\partial f}{\partial z}dz$.

If $u = \exp(x^2 + y^2)\sin z$, then the expression for du is given by

(A) $du = \exp(x^2 + y^2)[2xdx + 2ydy]\cos z + \sin z\ dz$

(B) $du = \exp(x^2 + y^2)[2xdx + 2ydy]\sin z + \cos z\ dz$

(C) $du = \exp(x^2 + y^2)[(2xdx + 2ydy)\cos z + \sin z\ dz]$

(D) $du = \exp(x^2 + y^2)[(2xdx + 2ydy)\sin z + \cos z\ dz]$

Q.22 Two dices are thrown simultaneously. The probability that the total number of dots is equal to 4 is

(A) $\frac{1}{6}$ (B) $\frac{1}{12}$ (C) $\frac{1}{18}$ (D) $\frac{1}{36}$

Q.23 The distribution function $P_X(k)$ of a random variable X with parameter λ, satisfies the relation

$$P_X(k+1) = \frac{\lambda}{k+1} P_X(k), \quad k = 0, 1, 2, 3 \ ....$$

If $P_X(0) = e^{-\lambda}$, the expression obtained for $P_X(k)$ from above relation is

(A) $P_X(k) = \frac{\lambda^k}{k!} e^{\lambda}$

(B) $P_X(k) = \frac{\lambda^{k+1}}{(k+1)!} e^{\lambda}$

(C) $P_X(k) = \frac{\lambda^k}{k!} e^{-\lambda}$

(D) $P_X(k) = \frac{\lambda^{k+1}}{(k+1)!} e^{-\lambda}$

Q.24 A curve in space is represented by a vector $\vec{r}(t) = x(t)\,i + y(t)\,j$

Q.34 Polypropylene is unstable to both heat and light because of

(A) Low melting point
(B) Very low T_g
(C) Presence of tertiary carbon
(D) Helical configuration of polymer chains

Q.35 Which of the following is a suitable catalyst during polycondensation of PET

(A) Triphenyl phosphite
(B) Trisnonyl phenyl phosphite
(C) Diphenyl terephthalate
(D) Antimony trioxide

Q.36 Choose the correct alternative for the following assertion-reason pair,
Assertion: In a wet spinning process, the counter diffusion of solvent and nonsolvent are essential in the coagulation bath for fibre formation
Reason: This ensures a constant diameter of the gel fibre

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

Q.37 Choose the correct alternative for the following assertion-reason pair,
Assertion: The birefringence of oriented textile grade acrylic fibre is negative
Reason: This is due to the presence of nitrile groups projecting outwards from the main polymer backbone

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

Q.38 Consider the elements in Group I and Group II and choose the correct alternatives from amongst A,B,C and D

	Group I		Group II
P	Viscose rayon	1	Unicellular
Q	Jute	2	Kidney shaped cross-section
R	Wet-spun acrylic fibre	3	Ultimate cells
S	Cotton	4	Serrated cross-section
		5	Dog bone shaped cross-section
		6	Cationic dyeable

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

Q.39 Consider the elements in Group I and Group II and choose the correct alternatives from amongst A,B,C and D

	Group I		Group II
P	X-ray diffraction	1	Crystalline orientation
Q	Infrared spectroscopy	2	Surface texture of fibres
R	Differential scanning calorimetry	3	Birefringence
S	Scanning electron microscopy	4	Thermal shrinkage
		5	Crystallinity
		6	Functional groups

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

Q.40 Cleaning efficiency (%) of blow room having four machines is 39.6. If the cleaning efficiencies of the first, second and fourth (last) machines are 10, 20 and 20 respectively, then that of the third machine is

(A) 24 (B) 26 (C) 28 (D) 30

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

Group I		Group II	
P	Ring yarn	1	Harsh and compact
Q	Rotor yarn	2	Strong and hairy
R	Air-jet yarn	3	Even and extensible
S	OE-friction yarn	4	Bulky and weak
		5	Strong and even
		6	Even and hairy

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

Q.42 During winding on the ring frame

(A) The downward movement of ring rail is slow and accelerating
(B) The downward movement of ring rail is fast and accelerating
(C) The upward movement of ring rail is slow and accelerating
(D) The upward movement of ring rail is fast and accelerating

Q.43 In a drawframe, higher top roller pressure is used for polyester fibres compared to cotton fibres because they have

(A) Lower compressional resilience
(B) Lower density
(C) Higher inter-fibre friction
(D) Lower moisture absorption

Q.44 The flyer leading mechanism in short staple roving frame is not used because of

P Design limitation of differential gear box
Q Energy consideration
R Slough-off problem
S Start up problem

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

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

Q.45 Quasi-periodic irregularity of slivers is caused by

(A) Higher short fibre content
(B) Broken gear tooth
(C) Roller eccentricity
(D) Improper meshing of gears

Q.46 If the specific volume of yarn is increased by 21%, the percentage increase in yarn diameter would be

(A) 4.6 (B) 10.0 (C) 10.5 (D) 21.0

Q.47 In a flat yarn, the number of filaments in the yarn cross section is 271. The yarn is divided into 5 segments of equal radial increments which are numbered as 1, 2, 3, 4 and 5, from yarn core to surface respectively. The approximate number of fibres in the 4th segment is

(A) 50 (B) 80 (C) 90 (D) 110

Q.48 In a card, theoretically it is beneficial to have smaller cylinder running at higher rpm because it

P Results in saving of space
Q Improves carding action
R Increases carding area
S Improves fibre transfer from licker-in to cylinder

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

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

Q.49 Consider the elements in Group I and Group II and choose the correct alternatives from amongst A,B,C and D

	Group I		Group II
P	Warp tension	1	Temple
Q	Draw string tension	2	Dagger
R	Warp protection	3	Lingoes
S	Fabric width	4	Back rest
		5	Reed
		6	Lease rod

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

Q.50 Consider the elements in Group I and Group II and choose the correct alternatives from amongst A,B,C and D

	Group I		Group II
P	Winding speed	1	150 m/min
Q	Warping speed	2	1000 m/min
R	Sizing speed	3	1500 m/min
S	Weaving (Weft Insertion Rate)	4	2500 m/min
		5	5000 m/min
		6	10000 m/min

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

Q.51 Consider the elements in Group I and Group II and choose the correct alternatives from amongst A,B,C and D

	Group I		Group II
P	Mean constant tension	1	Shedding
Q	Cyclic tension	2	Beat up
R	Random tension	3	Take-up/Let-off
S	Impact force	4	Warp entanglement
		5	Improper Knot
		6	Elasticity of warp yarn

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

Q.52 Excessive size makes the warp yarn

(A) Stiffer
(B) More extensible
(C) More hairy
(D) Better from the point of weaving

Q.53 As compared to an equivalent plain fabric, theoretically a 1x1 rib fabric is

(A) Four times as thick and twice as wide
(B) Half as thick and twice as wide
(C) Twice as thick and half as wide
(D) Twice as thick and twice as wide

Q.54 Consider the following statements in the context of sateen weave fabric and choose the INCORRECT statement

(A) The fabric provides maximum degree of smoothness and lustre
(B) One can observe prominent weave feature in the fabric
(C) The weave offers close packing of threads and heavy construction
(D) The fabric offers good hand and baggy garment

Q.55 Damage to cotton due to bleaching CANNOT be estimated by

(A) Methylene Blue Absorption
(B) Barium Number
(C) Cuprammonium Fluidity
(D) Tensile Strength

Q.56 Wurlan process is used to make wool shrink resistant. The treatment involves

(A) Masking scales by coating polyamide using interfacial polymerization
(B) Removing scales by atmospheric electric discharge
(C) Removing scales using sodium hypochlorite
(D) Masking scales by coating polyether followed by cross linking

Q.57 Consider the elements in Group I and Group II and choose the correct alternative from amongst A,B,C and D

Group I		Group II	
P	Polyester / cotton blend	1	Dyeing with vat dyes
Q	Nylon	2	Dyeing with metal complex dyes
R	Silk	3	Carbonization
S	Wool	4	Degumming
		5	Dyeing with mixture of disperse and reactive dyes
		6	Decatizing

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

Q.58 A dyed fabric changed its colour to a relatively paler shade when treated with alkaline sodium sulfate solution. This suggests that

(A) It was a vat dyed fabric
(B) The dye got oxidized
(C) The fabric was dyed from sulfur dyes
(D) The dye was sensitive to alkali

Q.59 In the context of dyeing of polyester with disperse dyes by exhaustion method, the relationship that holds good at any concentration of the dye in the bath [Cs], till saturation is achieved, where $[C_s]$ and $[C_f]$ are the dye concentrations in the solution and on the fibre respectively, is

(A) $[C_s] + [C_f]$ = constant
(B) $[C_s] / [C_f]$ = constant
(C) $[C_s]^{-1} + [C_f]^{-1}$ = constant
(D) $([C_s] + [C_f])^2$ = constant

Q.60 During roller printing a double line wavy streak was observed. This fault is due to

(A) Eccentricity of printing roller
(B) A cut in doctor blade
(C) Doctor lift
(D) End-to-end pressure difference on the printing roller

Q.61 For obtaining bright and clear prints in pigment printing, the thickener should

(A) Have a good binding power
(B) Have zero solid content
(C) Form a transparent film
(D) Form an elastic film

Q.62 Choose the correct alternative for the following assertion-reason pair,
Assertion [a]: Urea is invariably used in the reactive printing paste
Reason [r]: Urea is a source of nitrogen fixation during steaming

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

Q.63 In the context of foam finishing, the stability of foam increases if

(A) The processing temperature is increased
(B) Silicon based chemicals are added
(C) Viscosity builders are added
(D) Average bubble size is increased

Q.64 A cotton yarn shows an average strength of 250 gf. When the same sample was tested again the next day, a significant change in strength was observed. This could be due to

(A) Humidity fluctuation
(B) Ambient temperature fluctuation
(C) Variation in sunlight intensity through windows
(D) Wrong calibration of the instrument

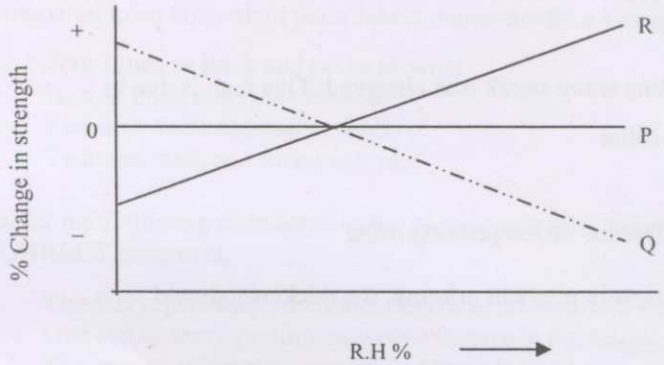
Q.65 When denier of a fibre is doubled, its diameter increases by

(A) 0.41 times (B) 1.41 times (C) Two times (D) Four times

Q.66 Work factor of glass fibre is

(A) Less than 1/2 (B) 1/2 (C) Greater than 1/2 (D) 1

Q.67 The relationship between the breaking strength and relative humidity of yarns made from four different fibres is shown in the following diagram. Choose the correct alternative to identify the fibres used to produce the yarns.



(A) P = Polyester
Q = Nylon
R = Cotton

(B) P = Nylon
Q = Cotton
R = Polyester

(C) P = Polyester
Q = Cotton
R = Nylon

(D) P = Nylon
Q = Polyester
R = Cotton

Q.68 In the context of flat fabric abrasion resistance, choose the correct statement.

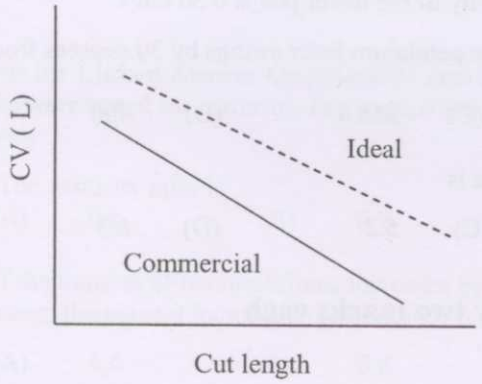
(A) Abrasion resistance of fabric increases with increase in yarn twist continuously
(B) There is no optimum fabric set for best abrasion resistance
(C) The pressure between abradant and sample can alter the ranking of a set of fabric for a particular abradant
(D) Yarns made from long and short fibres do not make any difference in abrasion resistance of the corresponding fabrics

Q.69 Pilling propensity on fabric surface increases with

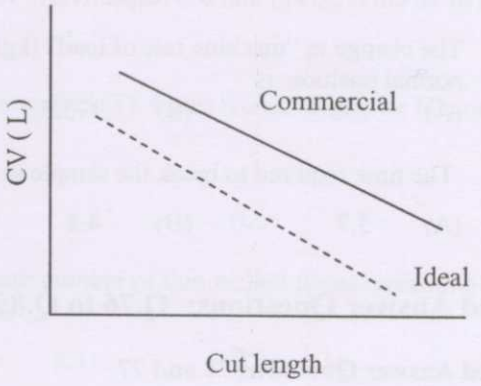
(A) Increase in length of fibre used in yarn
(B) Increase in yarn twist
(C) Decrease in inter fibre friction
(D) Decrease in fibre strength

Q.70 Out of the following four diagrams A, B, C, and D, the correct variance-length (VL) curve for an ideal and commercial yarns is represented by

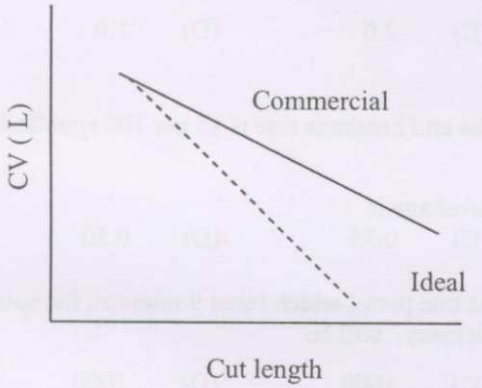
(A)



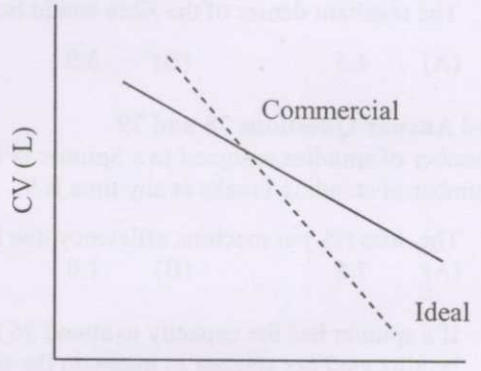
(B)



(C)



(D)



Common Data Questions

Common Data for Questions 71,72 and 73

A cotton fabric has 25 ends per cm, 28 picks per cm, warp count 30 tex, weft count 15 tex, warp crimp 12%. The diameter of the yarn is given by; 4.44×10^{-3} *(yarn tex / fibre density)*$^{1/2}$

Q.71 The ratio of warp way modular length to sum of thread diameters is

(A) 0.119 (B) 0.19 (C) 1.19 (D) 11.9

Q.72 The crimp (%) in weft yarn is

(A) 1.03 (B) 6.26 (C) 10.26 (D) 12.26

Q.73 The fabric thickness (mm) will be

(A) 0.04 (B) 0.36 (C) 3.62 (D) 13.62

Common Data for Questions 74 and 75

Assume that the "standard machine rate of loading" of a commercial tensile testing machine working on pendulum lever principle is 200 kgf /cm. The breaking load and extension of a sample tested at a gauge length of 20 cm is 50 kgf and 8% respectively. The velocity of the lower jaw is 0.50 cm/s.

Q.74 The change in "machine rate of load" (kgf /cm) as pendulum lever swings by 30 degrees from its normal position, is

(A) 100 (B) 173.2 (C) 346.4 (D) 400

Q.75 The time required to break the sample in seconds is

(A) 3.7 (B) 4.3 (C) 5.2 (D) 6.3

Linked Answer Questions: Q.76 to Q.85 carry two marks each

Linked Answer Questions 76 and 77

Q.76 A polymer melt (density = 0.95 g/cm^3), is being spun through a spinneret of 1000 holes. The mass throughput rate and take-up speed are 300 g/min. and 300 m/min. respectively. The nominal denier of the single filament is

(A) 12 (B) 9 (C) 6 (D) 3

Q.77 The above as-spun filament was subjected to two-stages drawing with a draw ratio of 1.5 and 2.0. The resultant denier of the fibre would be

(A) 4.5 (B) 3.0 (C) 2.0 (D) 1.0

Linked Answer Questions 78 and 79

The number of spindles assigned to a Spinner is 1200. The end breakage rate is 15 per 100 spindle-hours. The number of standing breaks at any time is 9.

Q.78 The loss (%) in machine efficiency due to end breakage is

(A) 7.5 (B) 1.0 (C) 0.75 (D) 0.50

Q.79 If a spinner has the capacity to attend 36 breaks in one patrol which takes 9 minutes, the spindles to be allocated per spinner to maintain the same efficiency, will be

(A) 800 (B) 1200 (C) 1600 (D) 2000

Linked Answer Questions 80 and 81

A precision winder has to wind 4 kg of yarn of 40 tex.

Q.80 If the machine winds at 800 m/min, without any interruption, the time (min) taken for winding would be

(A) 125 (B) 100 (C) 25 (D) 12.5

Q.81 If the efficiency of the machine is 91%, additional time (min) required to do the same job is approximately

(A) 10 (B) 12 (C) 15 (D) 25

Linked Answer Questions 82 and 83

A knitted fabric is to be dyed with a low substantive dye to 2% shade using exhaust method.

Q.82 If the dye concentration is set to 1 g/l , the material to liquor ratio, assuming 50% exhaustion at equilibrium, would be

(A) 25 (B) 2.5 (C) 0.25 (D) 0.025

Q.83 If the liquor is drained after dyeing a 100 kg lot, the cost (Rs.) of treating the effluent at Rs. 10 per 100 liters is

(A) 800 (B) 400 (C) 200 (D) 100

Statement for Linked Answer Questions 84 and 85

100 fibres were tested for maturity. The normal (N) and thin-walled (T) fibres were found to be 60 and 20 respectively

Q.84 The maturity ratio is

(A) 0.6 (B) 0.7 (C) 0.8 (D) 0.9

Q.85 If the number of matured fibres increases by 10% with number of thin walled fibres remaining the same, the percent increase in maturity ratio would be

(A) 5.6 (B) 6.6 (C) 8.3 (D) 10

END OF THE QUESTION PAPER