Q. 1 – Q. 5 carry one mark each.

Q.1 Once the team of analysts identify the problem, we _____ in a better position to comment on the issue.

Which one of the following choices CANNOT fill the given blank?

(A) will be
(B) were to be
(C) are going to be
(D) might be

Q.2 A final examination is the _____ of a series of evaluations that a student has to go through.

(A) culmination
(B) consultation
(C) desperation
(D) insinuation

Q.3 If IMHO = JNIP; IDK = JEL; and SO = TP, then IDC = ____.

(A) JDE (B) JED (C) JDC (D) JCD

Q.4 The product of three integers X, Y and Z is 192. Z is equal to 4 and P is equal to the average of X and Y. What is the minimum possible value of P?

(A) 6 (B) 7 (C) 8 (D) 9.5

Q.5 Are there enough seats here? There are _____ people here than I expected.

(A) many (B) most (C) least (D) more

Q. 6 – Q. 10 carry two marks each.

Q.6 Fiscal deficit was 4% of the GDP in 2015 and that increased to 5% in 2016. If the GDP increased by 10% from 2015 to 2016, the percentage increase in the actual fiscal deficit is ___.

(A) 37.50 (B) 35.70 (C) 25.00 (D) 10.00

Q.7 Two pipes P and Q can fill a tank in 6 hours and 9 hours respectively, while a third pipe R can empty the tank in 12 hours. Initially, P and R are open for 4 hours. Then P is closed and Q is opened. After 6 more hours R is closed. The total time taken to fill the tank (in hours) is ____.

(A) 13.50 (B) 14.50 (C) 15.50 (D) 16.50

Q.8 While teaching a creative writing class in India, I was surprised at receiving stories from the students that were all set in distant places: in the American West with cowboys and in Manhattan penthouses with clinking ice cubes. This was, till an eminent Caribbean writer gave the writers in the once-colonised countries the confidence to see the shabby lives around them as worthy of being "told".

The writer of this passage is surprised by the creative writing assignments of his students, because _____.

(A) Some of the students had written stories set in foreign places
(B) None of the students had written stories set in India
(C) None of the students had written about ice cubes and cowboys
(D) Some of the students had written about ice cubes and cowboys

Q.9 Mola is a digital platform for taxis in a city. It offers three types of rides – Pool, Mini and Prime. The Table below presents the number of rides for the past four months. The platform earns one US dollar per ride. What is the percentage share of revenue contributed by Prime to the total revenues of Mola, for the entire duration?

Type	Month			
	January	February	March	April
Pool	170	320	215	190
Mini	110	220	180	70
Prime	75	180	120	90

(A) 16.24 (B) 23.97 (C) 25.86 (D) 38.74

Q.10 X is an online media provider. By offering unlimited and exclusive online content at attractive prices for a loyalty membership, X is almost forcing its customers towards its loyalty membership. If its loyalty membership continues to grow at its current rate, within the next eight years more households will be watching X than cable television.

Which one of the following statements can be inferred from the above paragraph?

(A) Most households that subscribe to X's loyalty membership discontinue watching cable television
(B) Non-members prefer to watch cable television
(C) Cable television operators don't subscribe to X's loyalty membership
(D) The X is cancelling accounts of non-members

END OF THE QUESTION PAPER

Q. 1 – Q. 25 carry one mark each.

Q.1 The value of $\lim_{x\to 0}\frac{e^x-1-x}{x^2}$ is

(A) $-\frac{1}{2}$ (B) 0 (C) $\frac{1}{2}$ (D) 1

Q.2 For x in $[0,\pi]$, the maximum value of $(\sin x + \cos x)$ is

(A) $\frac{1}{\sqrt{2}}$ (B) 1 (C) $\sqrt{2}$ (D) 2

Q.3 The eigenvalues of the matrix $\begin{pmatrix} 3 & 0 & 0 \\ 0 & 2 & -3 \\ 0 & 1 & -2 \end{pmatrix}$ are

(A) $-1, 1, 3$ (B) $-3, 2, -2$ (C) $3, 2, -1$ (D) $3, 2, 1$

Q.4 Acrylic fibre is made from at least 85% by weight of

(A) Acrylic acid
(B) Acrylonitrile
(C) Acrylamide
(D) Methyl methacrylate

Q.5 The pair of natural fibres, belonging to the category of seed fibre, is

(A) Cotton and Sisal (B) Kenaf and Kapok
(C) Cotton and Kenaf (D) Cotton and Kapok

Q.6 The term 'half-lap' is associated with

(A) Card (B) Drawframe (C) Comber (D) Roving frame

Q.7 In a modern card, the highest angular velocity (rpm) is found in

(A) Feed roller (B) Taker-in (C) Cylinder (D) Doffer

Q.8 For multifilament yarns, optimum add-on (%) of size is in the range

(A) 0-0.5 (B) 4-8 (C) 20-25 (D) 30-35

Q.9 The movements of guide bars in warp knitting are

(A) Swinging and shaking
(B) Shaking and shogging
(C) Shogging and twisting
(D) Swinging and shogging

Q.10 Among the following options, the thickest Classimat fault is

(A) B3 (B) D1 (C) G (D) H2

Q.11 Work factor of a perfectly elastic yarn is

(A) 0 (B) 0.5 (C) 1 (D) 2

Q.12 Barium Activity Number (BAN) of a cotton fabric was found to be 150. The fabric must have undergone

(A) Desizing only
(B) Desizing and scouring only
(C) Desizing and bleaching only
(D) Desizing, scouring and mercerization

Q.13 The gum present in the raw mulberry silk fibre is

(A) Sericin (B) Fibroin (C) Keratin (D) Casein

Q.14 The value of k for which the matrix $\begin{pmatrix} k & 2 \\ 3 & 1 \end{pmatrix}$ does not have an inverse is _____ .

Q.15 If a continuous random variable has the following probability density function

$$f(x) = \begin{cases} kx^3, & 0 \le x \le 1, \\ 0, & \text{otherwise;} \end{cases}$$

then the value of k is _____ .

Q.16 A blend of nylon 6 and polyester fibres when dissolved in formic acid at room temperature leaves a bone dry residue of 40% by weight. The weight fraction of polyester in the blend (rounded off to 1 decimal place) is _____ .

Q.17 Molecular weight of the repeat unit of poly (ethylene terephthalate) is _____ .

Q.18 Six carded slivers of 4 ktex each are drawn to produce a sliver of 5 ktex. The draft required (rounded off to 1 decimal place) is _____ .

Q.19 The ratio of yarn tensile modulus to fibre tensile modulus, where the surface fibres are inclined at a twist angle of 25°, (rounded off to 2 decimal places) is _____ .

Q.20 If the linear density (tex) of a yarn is doubled, then percentage increase in tightness factor of single jersey knitted fabric (rounded off to 1 decimal place) is _____ .

Q.21 A square plain jammed fabric has yarns with circular cross-section. If the yarn diameter is 0.02 cm, then number of ends per cm (rounded off to 1 decimal place) is _____ .

Q.22 If the moisture content of a fibre is 10%, its moisture regain (%) (rounded off to 2 decimal places) is _____ .

Q.23 The 2.5% span length and uniformity ratio of a particular variety of cotton fibre are 30 mm and 45%, respectively. The 50% span length (mm) of the fibre (rounded off to 1 decimal place) is _____ .

Q.24 A wool fabric is to be dyed with an acid dye to a shade of 4% on the weight of fabric (owf). The material to liquor ratio is 1:40 and the exhaustion is 100%. The concentration (gpl) of the dye in the initial dye bath is _____ .

Q.25 A cellulosic fabric has been treated with boric acid to impart flame retardancy. The wet expression is 100%. The molecular weight of boric acid is 62 and the atomic mass of boron is 11. Assume that no chemical reaction takes place between boric acid and the fibre. If 2.2 % boron has been added on the weight of fabric (owf), then the add-on of boric acid on fabric (% owf) (rounded off to 1 decimal place) is_____.

Q. 26 – Q. 55 carry two marks each.

Q.26 One of the points which lies on the solution curve of the following differential equation

$$2xy\,dx + (x^2 + y^2)\,dy = 0$$

with the initial condition $y(1) = 1$ is

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

Q.27 Let X be a binomial random variable with mean 1 and variance $\frac{3}{4}$. The probability that X takes the value 3 is

(A) $\frac{3}{64}$ (B) $\frac{3}{16}$ (C) $\frac{27}{64}$ (D) $\frac{3}{4}$

Q.28 Match the process steps in viscose fibre manufacture listed in Group I with the corresponding chemicals given in Group II. The correct option is

Group I	Group II
P. Ageing	1. Carbon disulphide
Q. Steeping	2. Zinc sulphate
R. Xanthation	3. Sodium hydroxide
S. Wet spinning	4. Manganese salt

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

Q.29 The correct combination of techniques to determine the crystallinity in fibres is

(A) TGA and DSC
(B) Birefringence and DSC
(C) X-ray diffraction and Density measurement
(D) Birefringence and X-ray diffraction

Q.30 Determine the correctness or otherwise of the following Assertion [a] and Reason [r]

[a] : Kevlar fibre has high strength and high modulus.
[r] : It has high orientation and low crystallinity.

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

Q.31 An opening roller in blowroom with 100 cm length, 38 cm diameter and 2 teeth per cm^2 is rotating at an angular velocity of 400 rpm to deliver fibre tufts at a production rate of 500 kg/h. The intensity of opening (fibre mass in mg per tooth) of the opening roller approximately is

(A) 0.44 (B) 0.87 (C) 1.74 (D) 2.74

Q.32 A drawframe with a 3 over 3 drafting arrangement, having an eccentric bottom middle roller of 28 mm diameter, is used to produce a sliver. The back zone and front zone drafts are 1.7 and 3.5, respectively. The sliver is further given a draft of 200 to produce a yarn. The wavelength (m) of the periodic fault in the yarn approximately is

(A) 17.6 (B) 29.9 (C) 61.6 (D) 104.7

Q.33 Determine the correctness or otherwise of the following Assertion [a] and the Reason [r]

[a] : The short term mass irregularity of rotor yarn is less than that of ring yarn.
[r] : Rotor yarn has belt or wrapper fibres, but ring yarn does not.

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

Q.34 Match the looms listed in Group I with the corresponding components given in Group II. The correct option is

Group I	Group II
P. Shuttle loom	1. Beat-up comb
Q. Projectile loom	2. Torsion rod
R. Air-jet loom	3. Crank shaft
S. Multiphase loom	4. Relay nozzles

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

Q.35 The punch density of a needle-punched nonwoven fabric is 50 punches/cm^2. If the stroke frequency of needle bed is doubled and the fabric delivery speed is halved, then the punch density (punches/cm^2) would be

(A) 25 (B) 50 (C) 100 (D) 200

Q.36 In air-jet weaving, the correct combination of parameters, on which drag force on weft yarn depends, is

P. Weave pattern Q. Density of air R. Weft yarn diameter S. Picks per cm

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

Q.37 The correct combination of reasons, which leads to decrease in tear strength of a woven fabric, is

P. Increase in yarn to yarn friction
Q. Decrease in yarn to yarn friction
R. Increase in fabric sett
S. Decrease in fabric sett

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

Q.38 Match the instruments listed in Group I with the corresponding operating principles given in Group II. The correct option is

Group I	Group II
P. Uster evenness tester	1. Photoelectric effect
Q. Stelometer	2. Spring extension
R. Cambridge extensometer	3. Pendulum lever
S. Shirley yarn hairiness tester	4. Capacitance

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

Q.39 The set containing oxidative bleaching agents only is

P. Sodium hydrosulphite
Q. Thiourea dioxide
R. Sodium hypochlorite
S. Hydrogen peroxide

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

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

[a] : Synthetic thickeners used in pigment printing are neutralized before printing.
[r] : Without neutralization, the viscosity required for printing would not be achieved.

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

Q.41 Determine the correctness or otherwise of the following Assertion [a] and Reason [r]

[a] : The equilibrium dye uptake by a fibre decreases with increasing dyeing temperature.
[r] : Dyeing is an endothermic process.

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

Q.42 The value of the integral $\frac{6}{\pi}\int_0^{\pi/2}\frac{\cos 2x}{1+\sin x}dx$ obtained using Simpson's $\frac{1}{3}$ rule (rounded off to 2 decimal places) is _____ .

Q.43 Let $\vec{a} = \lambda\,\hat{\imath} - 9\,\hat{\jmath} - \hat{k}$, $\vec{b} = 3\,\hat{\imath} + 3\,\hat{\jmath} + \hat{k}$ and $\vec{c} = 4\,\hat{\imath} + 2\,\hat{\jmath} + \hat{k}$. The value of λ for which the vector $\vec{a}$ is perpendicular to $\vec{b} \times \vec{c}$ is _____ .

Q.44 In melt spinning, the diameter of monofilament at the spinneret exit is 0.3 mm and at the take-up point is 0.15 mm. Assuming that there is no change in density of filament, the spin-draw ratio is _____ .

Q.45 The experimentally determined density of a fibre is 1.31 g/cc. If the density of the void free fibre is 1.35 g/cc, then the void volume fraction (%) of the fibre sample (rounded off to 2 decimal places) is _____ .

Q.46 The spindle speed of a ring frame, producing a yarn of 25 tex, is 25000 rpm and the rate of delivery is 25 m/min. The twist multiplier ($m^{-1}\cdot tex^{0.5}$) of the yarn is _____ .

Q.47 If the value of twist retraction of a yarn is 0.2, then the value of twist contraction (rounded off to 2 decimal places) is _____ .

Q.48 A yarn is passing through an additive type tensioner. The mass of dead weight on disc is 50 g and the coefficient of friction between yarn and disc is 0.3. If the input tension is 50 gf, then the output tension (gf) is _____.

Q.49 In a shuttle loom, if the loom speed (picks per minute) is increased by 20%, then the percentage increase in picking power required per meter of fabric is _____.

Q.50 A sample of 150 cotton fibres is tested for maturity. The number of normal and thin-walled fibres are 105 and 30, respectively. The rest are dead fibres. The maturity ratio is _____.

Q.51 In a vibroscope, the fundamental resonant frequency of fibre X is twice that of fibre Y. Keeping the test length and tensioning weight the same, if the linear density of fibre Y is 10 denier, then the linear density (denier) of fibre X (rounded off to 1 decimal place) is _____ .

Q.52 The 95% confidence limits of mean yarn tenacity (cN/tex) based on 100 test samples is 30 ± 1.5. The number of test samples required to obtain 95% confidence limits of 30 ± 0.5 is _____.

Q.53 A 180 denier polyester multifilament yarn, a 60 Ne cotton yarn and a 50 Nm (metric count) polyester/wool yarn are twisted together. The resultant linear density (tex) of the 3-ply yarn, neglecting twist contraction, (rounded off to 2 decimal places) is _____ .

Q.54 A polyester fabric is dyed with a disperse dye till equilibrium is reached. If the concentration of the dye in the spent dyebath is 0.05 gpl and the partition coefficient is 1000 ml/g, then amount of dye in the fibre (g/100 g) is _____.

Q.55 A wet polyester fabric has areal density of 160 g/m^2. The initial temperature of the wet fabric is 20°C. After it is completely dried on a cylinder dryer, its areal density drops to 100 g/m^2.

Consider,

- Specific heat of polyester as 2.0 J/g °C
- Specific heat of water as 4.2 J/g °C
- Latent heat of evaporation of water as 2260 kJ/kg

Assuming that there is no heat loss, the energy (kJ) required to dry 1 m^2 of the fabric (rounded off to 2 decimal places) is _____.

END OF THE QUESTION PAPER

Q.No.	Type	Section	Key	Marks
1	MCQ	GA	B	1
2	MCQ	GA	A	1
3	MCQ	GA	B	1
4	MCQ	GA	Mark to All	1
5	MCQ	GA	D	1
6	MCQ	GA	A	2
7	MCQ	GA	B	2
8	MCQ	GA	B	2
9	MCQ	GA	B	2
10	MCQ	GA	A	2
1	MCQ	TF	C	1
2	MCQ	TF	C	1
3	MCQ	TF	A	1
4	MCQ	TF	B	1
5	MCQ	TF	D	1
6	MCQ	TF	C	1
7	MCQ	TF	B	1
8	MCQ	TF	B	1
9	MCQ	TF	D	1
10	MCQ	TF	A	1
11	MCQ	TF	B	1
12	MCQ	TF	D	1
13	MCQ	TF	A	1

Q.No.	Type	Section	Key	Marks
14	NAT	TF	6 to 6	1
15	NAT	TF	4 to 4	1
16	NAT	TF	0.4 to 0.4	1
17	NAT	TF	192.0 to 192.5	1
18	NAT	TF	4.7 to 4.9	1
19	NAT	TF	0.81 to 0.83	1
20	NAT	TF	40.0 to 43.0	1
21	NAT	TF	24.0 to 34.0	1
22	NAT	TF	11.00 to 11.20	1
23	NAT	TF	13.0 to 14.0	1
24	NAT	TF	1 to 1	1
25	NAT	TF	12.2 to 12.6	1
26	MCQ	TF	A	2
27	MCQ	TF	A	2
28	MCQ	TF	B	2
29	MCQ	TF	C	2
30	MCQ	TF	D	2
31	MCQ	TF	B	2
32	MCQ	TF	C	2
33	MCQ	TF	B	2
34	MCQ	TF	C	2
35	MCQ	TF	D	2
36	MCQ	TF	B	2

Q.No.	Type	Section	Key	Marks
37	MCQ	TF	A	2
38	MCQ	TF	D	2
39	MCQ	TF	C	2
40	MCQ	TF	A	2
41	MCQ	TF	D	2
42	NAT	TF	0.24 to 0.28	2
43	NAT	TF	3 to 3	2
44	NAT	TF	4 to 4	2
45	NAT	TF	2.60 to 3.00	2
46	NAT	TF	5000 to 5000	2
47	NAT	TF	1.24 to 1.26	2
48	NAT	TF	79 to 81	2
49	NAT	TF	41 to 45	2
50	NAT	TF	1 to 1	2
51	NAT	TF	2.5 to 2.5	2
52	NAT	TF	900 to 900	2
53	NAT	TF	49.50 to 50.00	2
54	NAT	TF	5 to 5	2
55	NAT	TF	170.00 to 173.00	2