

**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
FACULTY OF INDUSTRIAL TECHNOLOGY
DEPARTMENT OF TEXTILE TECHNOLOGY
FIRST SEMESTER EXAMINATIONS DECEMBER 2005
YARN TECHNOLOGY TXT 2107**

Time: 3 hours

Instructions to Candidates

Answer all questions in Section A (40 marks in total) and any THREE in Section B (60 marks in total). Total marks = 100

Section A

Question 1

- (a) Calculate the limit of irregularity for a 30tex yarn produced from fibre of 3.3 den linear density. (2 marks)
- (b) Calculate the coefficient of unevenness index variation after drawing given that a 14 ktex sliver was drafted to a 500 tex roving and that the CV% a mass before and after drafting is 3.6% and 7.9% respectively. (3 marks)

Question 2

- (a) Calculate the time taken by the carding action operation given that the length of the tuft is 80 mm and the speed of the main cylinder is 600m/min. (3 marks)
- (b) How does the rotor groove affect the properties of rotor spun yarn, consider a wide and a narrow groove. (3 marks)

Question 3

Calculate the maximum permissible eccentricity given that the draft is 14, diameter of top and bottom rollers is 1 inch and the maximum permissible CV% of mass caused by the drafting rollers is 5.7%. (4 marks)

Question 4

Suppose a ring spinning machine is fed with two roving with an average CV% of mass of 12% and produces a yarn with irregularity of 14%. What is the CV% of mass introduced by the spinning system. (3 marks)

Question 5

- (a) Calculate the corrected traveler speed given that the spindle speed is 16 000 rpm, ring diameter is 57mm, front roller delivery speed is 24m/min and package circumference is 102 mm, take up factor K to be = 0.98 (3 marks)
- (b) To maintain the same traveler speed, what will be the spindle speed if the ring diameter was reduced to 40 mm. (2 marks)

Question 6

In conventional draft distribution, it is the second roller that slips. How can the draft be changed to reduce the critical weighting of the second roller.

(4 marks)

Question 7

(a) Given that the length of the intensive carding arc is 20mm, that of the subsequent carding arc is 35 mm, the speed of the main cylinder is 700m/min and that of the worker is 5m/min.

(i) Calculate the length of the carding arc. (3 marks)

(ii) What conclusion is drawn on the function of the taker-in. (2 marks)

(b) What are the possible operations used to increase the carding arc and what limitations do they give? (8 marks)

SECTION B (Answer any three)**Question 8**

(a) Discuss methods and instruments used to determine the unevenness in linear density of spinning products. (14 marks)

(b) Outline the drawbacks of each system. (8 marks)

Question 9

(a) With the help of a diagram outline the whole cycle of an auto weigher mechanism. (8 marks)

(b) With the aid of a diagram explain the operational principle of an electromechanical autoweigher. (7 marks)

(i) Discuss the principle of twist insertion in the dref/friction spinning mechanism, what are the problems associated with this type of twist insertion. (3 marks)

(ii) From the above principle, formulate a general expression for twist insertion in the system. (2 marks)

Question 10

- (a) Show that yarn tension in ring spinning is

$$F = \frac{\mu m w^2 R^2}{r}$$

where; μ is the coefficient of friction between the yarn and the traveler.

- m = mass of the traveler
w = angular velocity of the traveler
R = radius of the ring
r = diameter of the package (16 marks)
- (b) What practical conclusions are drawn from this formula? (4 marks)

Question 11

- (a) What are the conditions to be observed in:
(i) carding action
(ii) stripping action
(iii) elimination of impurities on the strippers (6 marks)
- (b) By balancing and indicating the forces acting on the card cloth wires show that $\cot \alpha > \mu$ where α is the angle of inclination of the card cloth wires and μ is the coefficient of friction between the wires and fibres. (4 marks)
- (c) In the interaction of the feed rollers, taker-in and main cylinder of burr breast roller, how are impurities removed in:
(i) downward movement of the taker-in (3 marks)
(ii) Upward movement of the taker-in (3 marks)
- (d) What is the significance of the relative speed of liker-in and feed rollers on fibre breakages and impurity elimination? (4 marks)

Question 12

- (a) Outline how drafting waves are formed during roller drafting. (5 marks)
- (b) Outline factors causing periodic variations in roller drafting. (10 marks)
- (c) Calculate the maximum rotor speed that can be achieved given that the rotor diameter is 30 mm and the explorable yarn breaking strength is 0.5kg for a 30 tex yarn. (5 marks)

END OF QUESTION PAPER

