Seat No.: _____ Enrolment No._____

GUJARAT TECHNOLOGICAL UNIVERSITY

ME – SEMESTER-1 (NEW) EXAMINATION – WINTER 2016

Subject Code: 2712508 **Date:04/01/2017**

Subject Name: Theory of Yarn Structure

Time: 2:30 pm to 5:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1	**(a)**	The stress-strain curve for the acetate yarn is defined by $X=a + b\varepsilon_f$. Derive the expression to predict the yarn tenacity in terms of surface twist angle α. Define α.	**11**
	(b)	Using equations derived by El Mogahzy, calculate diameter of 20s Ne cotton yarn if spun by Ring, Rotor and MJS air jet spinning system.	**03**
Q.2	**(a)**	How to calculate idealized number of fibres in various layers in case of open packing? Calculate number of fibres in 6th layer considering idealized open packing.	**07**
	(b)	Calculate following 1. 160/72/200 Polyamide filament yarn has a packing factor of 0.91. The yarn is subjected to a strain up to 11.0 %. Assuming coaxial helical geometry and constant volume deformation, will the yarn be able to sustain the strain if the filament breaking strain is 9.6 %? 2. What will be the value of the mean fiber position for perfect migration for a staple yarn if $\mathbf{V_y} = 1.2$ and $\boldsymbol{\tau} = 44$	**07**
		OR	
	(b)	Prove theoretically that the number of filaments crossing corresponding to any given increment of length is constant.	**07**
Q.3	**(a)**	Compare structural aspects of Compact Spun, Open End and Air jet spun yarns.	**07**
	(b)	For ideal and perfect migration, prove that RMS deviation (D) is 0.3.	**07**
		OR	
Q.3		Derive an equation of triangular wave form of first cycle of migration pattern assuming linear approximation.	**14**
Q.4		Derive theoretical prediction equation of yarn tenacity for $\boldsymbol{\varepsilon_f} < 10$ %	**14**
		OR	
Q.4		Derive an equation to predict filament strain $\boldsymbol{\varepsilon_f}$ for large value of $\boldsymbol{\varepsilon_y}$.	**14**
Q.5	**(a)**	Prove that the length of fiber in a yarn is proportional to the square of radius of yarn. Write in brief on three basic parameters of migration.	**08**
	(b)	(i) Calculate diameter of individual filament of polyacrylonitrile yarn having 76/34/350 specification (considering ideal packing). (ii) Hamilton yarn geometer gave the following values: Yarn major dia = 290 microns Yarn minor dia = 180 microns If the yarn count is 16^s Ne and fiber specific volume is 0.657 cm^3/g, estimate packing factor.	**06**
		OR	

Q.5 Explain the rupture behavior of spun yarns by the modified qualitative approach and derive **14**

$$\frac{\text{Yarn Modulus}}{\text{Fibre Modulus}} = \cos^2 \alpha(1 - k\operatorname{cosec}\alpha)$$

giving the expression for k.

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