

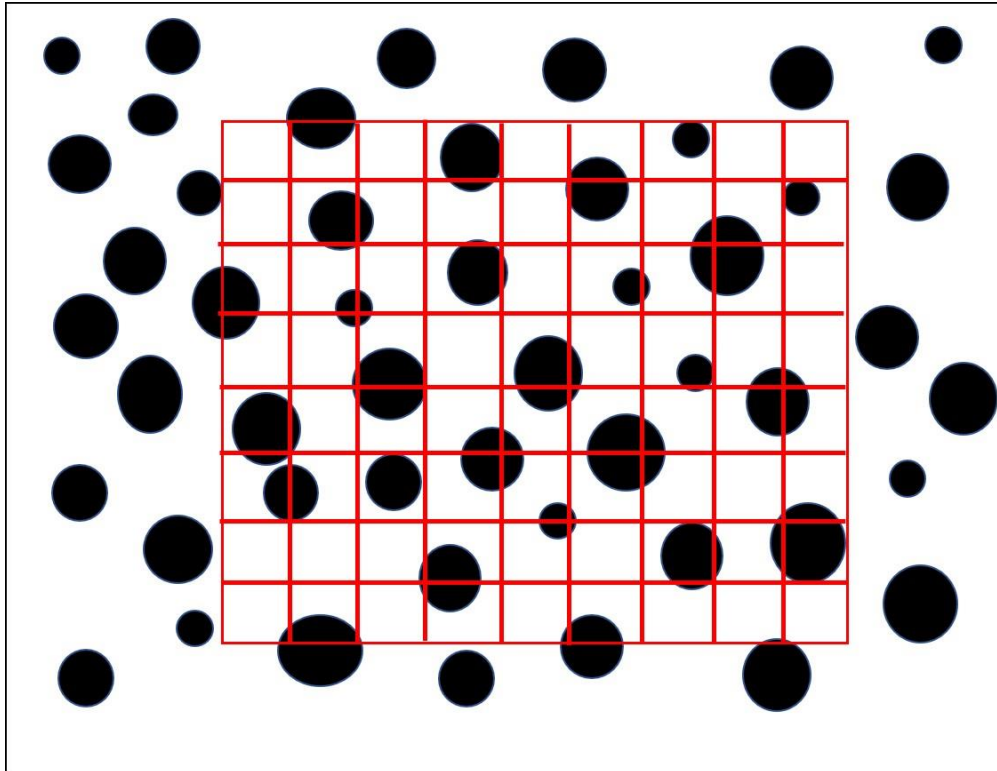
**Assignment-VII**  
**Heat treatment and Surface hardening – II**  
**NPTEL-Mooc-7<sup>th</sup> week**

1. Hari did one experiment by heating a eutectoid steel specimen to 1000°C followed by cooling and isothermally holding in a salt bath at 650°C for different durations. The steel samples were then quenched in water. Final microstructure obtained is the mixture of pearlite and martensite. The fraction of pearlite obtained after different durations is listed in the following table

<b>t = Time (s)</b>	<b>f(t) = Pearlite fraction</b>
85	0.02
185	0.18
220	0.45
235	0.8
310	0.97

- If the transformation follows  $f(t) = 1 - \exp(-kt^n)$  then value of n after fitting a straight line is \_\_\_\_\_
- (a) 3.75  
(b) 4.92  
(c) 4.45  
(d) 4.02
2. In question no. 1, the value of k is \_\_\_\_\_
- (a)  $3.85 \times 10^{-9}$   
(b)  $2.85 \times 10^{-10}$   
(c)  $5.65 \times 10^{-11}$   
(d)  $6.55 \times 10^{-12}$
3. In question no. 1, the fraction transformed corresponding to the maximum rate of transformation is \_\_\_\_\_.
- (a) 49.2 %  
(b) 54.8 %  
(c) 52.8 %  
(d) 55.1 %
4. The value of total and residual variability from least squares method in the estimation of n and k of Avrami equation will be \_\_\_\_\_, respectively

- (a) 14.02, 0.85
  - (b) 16.20, 0.77
  - (c) 13.48, 0.65
  - (d) 17.85, 0.91
5. The goodness of fit ( $R^2$ ) in the above question will be \_\_\_\_\_
- (a) 0.937
  - (b) 0.984
  - (c) 0.993
  - (d) 0.952
6. If the exponent  $n$  in Avrami equation is changed from 2 to 3, the fraction transformed corresponding to the maximum rate of transformation will change by \_\_\_\_\_%.
- (a) 23.8
  - (b) 20.6
  - (c) 26.4
  - (d) 29.2
7. In the least squares method, if the  $SS_{\text{res}} = 0$ , which of the following statement is correct
- (a) This will give the worst fit
  - (b) This will give the perfect fit
  - (c) The fitted line must pass through 99% of the data points
  - (d) The fitted line must pass through 50% of the data points
8. Using point counting method, the volume fraction of the features shown in black in the figure below, will be \_\_\_\_\_. (mark the closest answer)



(a) 16.2

(b) 25.5

(c) 34.2

(d) 40.7

9. Based on the results of the above question and using the horizontal lines only (all 9 lines), the size (mean intercept length) of black features is \_\_\_\_\_. (mark the closest answer) [Assume the length of each line to be 50  $\mu\text{m}$ ]

(a) 4.7

(b) 2.5

(c) 8.2

(d) 12.3

10. Which of the following stereological relationship is **not** correct?

(a)  $S_V = \left(\frac{4}{\pi}\right)L_A$

(b)  $S_V = 3P_L$

(c)  $L_A = \left(\frac{\pi}{2}\right)P_L$

(d)  $V_V = A_A = P_P$