

BENGAL ENGINEERING AND SCIENCE UNIVERSITY, SHIBPUR
B.E. 7TH SEMESTER (MinE) FINAL EXAMINATION, 2011
Elective I (Geostatistics) (MN 706/1)

Full Marks: 70

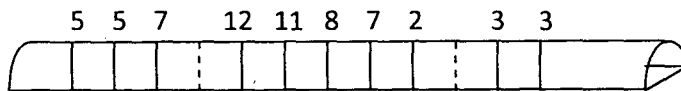
Time: 3 hrs

Answer any FIVE questions

Marks are indicated on the right margin of the questions

Students are allowed to use the charts and figures of Auxiliary functions and normal distribution

1. a) Explain covariogram and correlogram in light of Geostatistics?
- b) Assume that samples have been taken at equal intervals along a drive. Some samples are missing, and the values obtained are given in the following figure.



Calculate semivariogram for lags of 2 and 3.

[4+2×5=14]

2. a) What is the relation between regularized semivariogram and point semivariogram.
- b) Consider a borehole whose core has been divided into samples of equal length L down the hole. If the point semivariogram $\gamma(h)$ is linear of slope 1 calculate the regularized semivariogram $\gamma_L(h)$ for $h \geq L$, provided the core diameter is small with respect to L .
- c) Enumerate different 'Auxiliary Functions' in a 2-dimensional plane.

[2+6+6=14]

3. a) Define 'dispersion variance' and 'variance additivity relationship'.
- b) Consider an iron ore deposit which is known to follow a normal distribution with a mean of 48%Fe and a standard deviation of 5%Fe. This distribution has been established on samples small enough to be called 'points'. The deposit follows a point semi-variogram model which is spherical with a range of influence of 400 ft and sill $25 (\%)^2$. If the cut-off grade is 44%Fe, how much of the deposit will be ore and what will be average grade of that ore?
- c) In the above deposit if the block dimension is 100ft by 50ft what will be the standard deviation?

[2+7+5=14]

4. a) What do you mean by extension variance and estimation variance?
- b) Derive the expression for estimation variance.
- c) A copper deposit is characterized by spherical semivariogram with sill $5(\%)^2$ and range of influence of 10 metres without any nugget effect. Calculate the estimation variance of a block W of size 3m by 3m having only one sample located at the corner of block W.

[2+6+6=14]

5. Consider a disseminated nickel deposit in the late stages of development. On a particular underground level, the block of size 50m by 40 m needs to be estimated. This panel has been developed along two sides and the information available consists of (i) the average grade along the 50 m drive, g_1 and (ii) the average grade along the 40m drive, g_2 . If the average of these two grades are used to estimate the value inside the panel what will be the estimation variance?

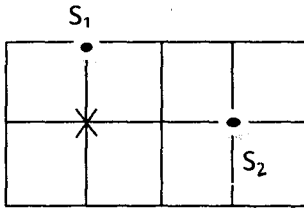
Deposit follows spherical model with range 60m and sill 0.75(%)

[14]

6. Enumerate Kriging error in terms of average semivariogram by taking two samples when mean grade is unknown, then generalize the relations. Show in a Matrix form also.

[14]

7. Consider an experimental semivariogram for a vein type silver deposit fitted by a spherical semivariogram model having a range (a)=250 ft and sill (C)=66. The following figure with 100 ft by 100 ft grids shows the relationship of two samples S_1 (8.2 oz/ton) and S_2 (9.6 oz/ton) and X marks the point at which the grade of silver will have to be estimated.



i) Set up the Kriging system of equations.

ii) Estimate the grade at X and Kriging Error.

[6+4+4=14]

8. Consider a mineral deposit where the semivariogram follows a spherical model with sill $C=2$ and range $a=10$. Calculate the Kriging estimator and Kriging variance for the block W (dark rectangle) in the following figure with the help of the point samples w_1 and w_2 .

[14]

15 5 20 W

