EMC COURSE ON MINE AUTOMATION AND MAINTENANCE
1-5 OCT, 2001, HELSINKI, FINLAND

TOTAL MARKS: 100
PASS MARKS: 50
TIME: 3 Hours

QUESTIONS- AUTOMATION AND MAINTENANCE

QUESTIONS ON AUTOMATION AND ROBOTICS (Total 30 points each question 7.5 points)

1. Define the term AUTOMATION and ROBOTICS? Discuss the potential and problems associated with automation and robotization of underground mining operation.
2. Discuss the different types of underground navigation systems available in market for possible use by the mining companies. What is Infra free navigation system used by Tamrock test mine?
3. Define reliability. Why is it important to consider software and human reliability for an automatic operating system?
4. Real time information management is key to the success of mine automation. Discuss the 4 essential elements for successful real time information management

QUESTIONS- ON MINE MAINTENANCE (Total 70 points , each question 5.0 points)

1. You have been appointed as a maintenance manager of a newly built process plant. Discuss the factors that you would like to examine and analyze before deciding the maintenance goal (objective) and strategy for your plant.
2. What is the purpose of maintenance process in a production environment? What difference it make if you perceive maintenance as a function instead of process?
3. We know that it is difficult to track down the indirect cost (e.g. extra capacity, cost of quality, production losses, high insurance premium, cost of idle labour etc.). List the factors that affect the indirect costs. Give examples to support your arguments.
4. What is meant by design out maintenance and design for maintenance?
5. Discuss the statement that LCC is also an effective engineering tool"
6. Define 'failure' and the failure development process.
7. List the different basic tools of maintenance analysis that can be used for studying maintenance problem.
8. Define maintainability and discuss the desirable maintenance characteristics.
9. A certain unit has R (100) = 0.7. How many units of this type are needed in a parallel system to get $R_p(100) > 0.95$?
10. Make a TTT-plot using the following times between failure data from an LHD machines at the LKAB Kiruna mine:TBF: 18, 33, 50, 99, 68. (in hours). What are your conclusions from the plot? Estimate the optimal maintenance interval given that the cost of repair is three times if the bearing fails during operation compared to the preventive maintenance costs.
11. Describe different types of benchmarking being used by industries.
12. What are the key features in application of RCM and TPM?
13. Why should we need maintenance performance indicators? List 5 maintenance indicators being used in industry.
14. What is condition based maintenance. What are the different methods used for condition monitoring of equipment?