



SHEKHAWATI INST. OF ENG.& TECHNOLOGY COLLEGE  
SIKAR , RAJASTHAN  
1<sup>st</sup> MID TERM EXAMINATION 2017-18 (B.TECH 4<sup>rd</sup> year - MI)  
Subject Code & Name: 8MI3 Rock Fragmentation

MM: 20

Time: 1.5hrs

## MODEL ANSWER PAPER

Q .1 Explain the causes of fly rock formation

### **PRIMARY CAUSES OF FLYROCK**

Generally, flyrock is caused by a mismatch of the explosive energy with the geomechanical strength of the rock mass surrounding the explosive charge. Factors responsible for this mismatch include: -

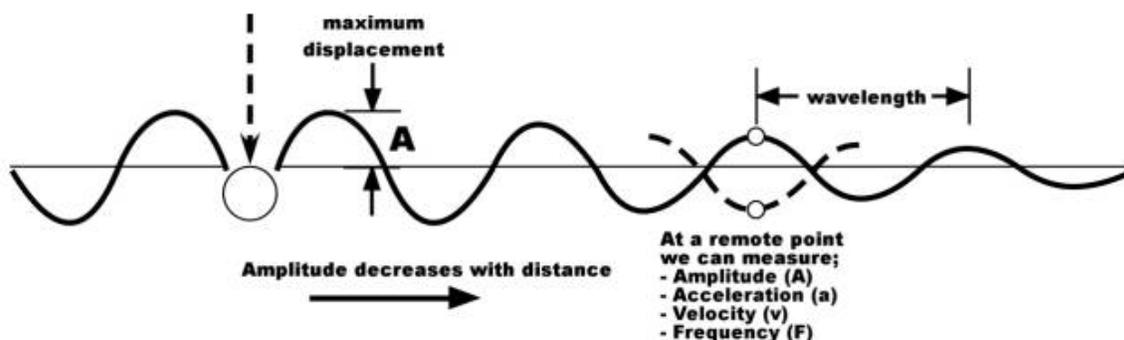
- High explosive concentration leading to localized high energy density, -
- Inadequate delay between the holes in the same row, or between the rows, -
- Inappropriate blast design, -
- Deviation of blast holes from its intended directions, -
- Improper loading and firing practice, including secondary blasting of boulders and toe holes.

### **CAUSES OF THE FLYROCK**

- Geology and Rock conditions :-
  - Mud seams, natural joint or bedding planes, fractures, or cavities
- Blast design
  - a. Improper blast design
  - b. Insufficient explosive confinement or the rapid venting of the explosive gases Blast design errors such as too high a powder factor
  - c. An inadequate burden
  - d. Too short a stemming region
  - e. Ineffective stemming material
  - f. Improper delays between rows
  - g. The wrong blasthole delay sequence

## Q.2 Explain the causes of Ground vibrations

When an explosive charge is detonated in a blasthole, the rock immediately surrounding the charge is fractured, split apart and may be displaced if the correct conditions exist. At a certain distance from the blasthole, the explosive energy released decreases to a level, which causes no further shattering or displacement, and continues to travel through the rock as an elastic ground vibration. The ground vibration radiates out from the hole with decreasing intensity and reduces to below levels of perception with distance. Ground vibration, at sufficiently high levels, will damage buildings but can be alarming to people inside buildings at levels well below structural damage levels. The energy travels in the form of waves, which may be illustrated by dropping a stone in a still pool of water. Near where the stone drops, waves are formed which spread concentrically out from the centre



In uniform rock conditions, the ground vibration waves will spread out and reduce equally in all directions, similar to the pond illustration. Blasts rarely consist of only one charge and rock is an imperfect medium for the transmission of vibration. The blast vibration consists of the different waves from many holes with propagation controlled by the physical and structural properties of the ground through which it travels.

## Q.3 Explain the process of controlled blasting technique

Controlled blasting methods are used to control adverse impacts such as: Over-break Reduce ground vibrations Reduce fractures within remaining rock walls Reduce noise Reduce dilution / waste of ore. Following are the techniques of controlled blasting: Line drilling, Trim (Cushion) blasting, Smooth (contour or perimeter) blasting, Pre-splitting, Selecting and employing various parameters of blast design, using modern technology, Precise and accurate timing delays, Muffle blasting at critical and congested areas

Line drilling: This system involves a single row of closely spaced uncharged holes along the neat excavation line. This provides a plane of weakness to which the primary blast can break. It also causes some of the shock waves generated by the blast to be reflected, which reduces shattering and stressing in the finished wall of the host rock. Line drill holes are generally percussive hammer holes having spaced two to four times the hole diameter, drilled along the excavation line. The blast holes directly adjacent to the line drill holes (buffer holes) are generally loaded lighter (about 50% of primary holes) and are closely spaced (about 50 to 75 %) than primary holes. This technique gives maximum protection to the host rock to preserve its original strength. The disadvantage of this system is high drilling cost due to closed spacing and results are often unsatisfactory because of poor hole alignment

Q.4 Explain air over pressure

Air overpressure is a transient impulse that travels through the atmosphere. Much of the air overpressure produced by blasting has a frequency below the audible limit of 20 Hz. Air overpressure, both audible and inaudible, can cause a structure to vibrate in much the same way as ground vibrations. It is a frequent cause of the complaints as a person senses air overpressure more than vibrations. The causes of generation are the energy released from unconfined explosives such as uncovered detonating cord trunk lines or mud caps used for secondary blasting, the release of explosive energy from inadequately confined borehole charges (inadequate stemming, inadequate burden, or mud seams) and the movement of the burden and the ground surface.