

Q.P. Code : 26761

[Time: Three (3) Hours]

[Marks:80]

- N.B:
1. Question.No.1 is compulsory.
 2. Attempt any **three (3)** questions from remaining **five (5)** questions.
 3. Assume suitable data wherever necessary.

1. Attempt any four from the following. 20
 - a. State difference between BPCS and SIS.
 - b. What is common cause failure?
 - c. Define: i) failure rate ii) MTTF iii) PFD iv) RRF v) MTBF
 - d. Write short note on dispersion.
 - e. A sack contains two types of marbles, all of the marbles are spotted or stripped and all of the marbles are either green or red. 60 % of the marbles are spotted. 90% of the marbles are green. What is the probability of marbles will be spotted OR green?
2. a. Draw and explain "Safety Instrumented System" with neat block diagram. Justify need of SIS. 10
 b. Explain designing steps for structured and auditable management of safety life cycle as per IEC standards. 10
3. a. i) Explain significance of safety life cycle. 05
 ii) Write short on separation of control and safety systems. 05
 b. Explain different SIS technologies with its advantages and disadvantages. 10
4. a. Consider a system composed of a transmitter, controller and valve. The probability of failure over the next 5 year period for each component is as follows. 10
 $P_{F(\text{transmitter})} = 0.15$
 $P_{F(\text{controller})} = 0.008$
 $P_{F(\text{valve})} = 0.19$
 Over the next 5 year interval, what is the probability of success of this system?
5. a. A water coolant supply system consists of two pumps; one is electrically driven and other is steam driven. Both pumps are continuously operating and together must supply an adequate amount of cool water. The probability of pump A's failure over the one year period is 0.02 and 0.03 is the probability of failing pump B. what is the probability that the cooling water system will fail to operate over the course of one year? Illustrate the situation using fault tree. 10
6. a. What is the procedure to carry out likelihood analysis? Explain different methods for the same. 10
 b. Draw and explain in detail, "layers of protection analysis" with neat onion diagram. 10
7. a. Explain SIL determination procedure with suitable flow chart. 10
 b. i) Explain difference and similarity between physical explosions and vapour cloud explosions 05
 ii) What are the effects of flammability hazards? 05
