

Total No. of Questions : 12]

SEAT No. :

P1100

[4659]-271

[Total No. of Pages : 3

B.E. (Petroleum Engineering)

**b - ADVANCED INSTRUMENTATION AND PROCESS CONTROL
IN PETROLEUM INDUSTRY**

(Elective - I) (Semester - I) (412384) (2008 Course)

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) *Answers to the two sections should be written in separate answer books.*
- 2) *Answer any three questions from each section.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume suitable data, if necessary.*

SECTION - I

- Q1)** a) Give the classification of electric motors. Explain with neat diagram principle, construction and working of DC motor. [8]
- b) Describe the various types of Logic Gates with its truth table used frequently in Oil and Gas Industries. [8]

OR

- Q2)** a) Give the difference between synchronous AC motor and induction motor. [8]
- b) With help of neat diagram discuss hazardous area classification for the conventional Drilling Rig. [8]

- Q3)** a) What is transducer? Define active and passive transducer and its examples with application in measuring system. [8]
- b) Define torque. Which are the different methods of torque measurement? Explain principle, construction and working of rotating strain gauge with neat diagram. [8]

OR

- Q4)** a) With help of neat diagram explain principle, construction and working of electromagnetic flowmeter. [6]
- b) Explain with neat diagram principle, construction and working of the mud level sensor. [6]
- c) Write a short note on H₂S Sensors. [4]

P.T.O.

- Q5)** a) What is the need of Process Control in Petroleum Industries explain with help of suitable examples. [6]
- b) Discuss the need of Tuning of Controllers and explain any one methodology. [6]
- c) With help of neat diagram explain overshoot, decay ratio, response time, rise time and damping factor. [6]

OR

- Q6)** a) Provide a neat diagram of a rectangular shaped tank getting filled with liquid incoming flow-rate of F_1 m³/hr and there is a hole at bottom of the tank through which liquid is drained constantly. Using series of experiments it was observed that draining rate (in m³/hr) can be predicted by $F_2 = \frac{h}{2.3}$ where h denotes height (in meters) of liquid present in the tank. Obtain the mathematical expression of the process. Write down assumptions clearly. Comment on dynamics of the process and its controllability issues. [10]
- b) Discuss the Proportional, Derivative and Integral mode of controller action with help of diagram. Provide mathematical expression of each. Why PID mode is considered to be the best of the lot - explain. [8]

SECTION - II

- Q7)** a) Compare the DCS, PLC and PC based control systems highlighting relative advantage and disadvantages. [9]
- b) With help of schematic diagram explain Cascade Control. Discuss the master and slave controller and the control mechanism in details. [9]

OR

- Q8)** a) What are the design goals of automatic remotely controlled fracturing processes explain with help of proper sketches. [6]
- b) Discuss the merits and usefulness of Feed-forward and Feed-back Control loops. [6]
- c) Crude and water need to be separated based on their differences in density inside a two-phase separator. Develop a programmable logic control (PLC) algorithm for this important process. Provide suitable diagram. [6]

- Q9) a)** Explain the Control Scheme of a production well along with the suitable sensors and control logic. [8]
- b) Write a detailed note on Crude Custody Transfer, Briefly explain the Geo-political factor and technical factors associated with it. [8]

OR

- Q10)a)** How does SCADA strategy is implemented in the UBD operation - explain with help of suitable example. [8]
- b) Dynamic Positioning of Floating Vessels in deep sea operations is very crucial and challenging. How is it practiced - explain with help of control diagram. [8]
- Q11)a)** Write a detailed note of Multiphase Flow Control in Upstream Industry.[8]
- b) Discuss in details the subsea operations and its dependence on modern day control architecture. [8]

OR

- Q12)a)** What are ROV actuators? Briefly explain their working principle. Also highlight the design aspects of such actuators. [8]
- b) Write short notes on any two: [8]
- i) Emergency Shutdown Systems.
 - ii) Sand Control Mechanisms.
 - iii) Design and control aspects of Subsea X-mas tree Structures.

