2014-15
B.TECH. (WINTER SEMESTER) EXAMINATION
PETROCHEMICAL ENGINEERING
PLANT SAFETY AND POLLUTION CONTROL
PK-421N

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions. Assume suitable data if missing. Notations used have their usual meaning.

<table>
<thead>
<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(a)</td>
<td>What is Process Safety? How it differs from industrial safety. Discuss the essential principle of safety.</td>
<td>[5]</td>
</tr>
<tr>
<td>1(b)</td>
<td>What is Hazard? Discuss various hazards that are encountered in hydrocarbon industry.</td>
<td>[5]</td>
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<td></td>
<td><strong>OR</strong></td>
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<tr>
<td>1(b')</td>
<td>What is Fire? Discuss various fire detection systems.</td>
<td>[5]</td>
</tr>
<tr>
<td>1(c)</td>
<td>Explain the concept of Total Quality Management in context with process industry.</td>
<td>[5]</td>
</tr>
<tr>
<td>2(a)</td>
<td>What is Explosion? How does it differ from fire? Discuss deflagration and detonation using the concept of pressure front and reaction front.</td>
<td>[6]</td>
</tr>
<tr>
<td>2(b)</td>
<td>What are the various indices for the measurement of toxicity?</td>
<td>[6]</td>
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<tr>
<td></td>
<td><strong>OR</strong></td>
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</tr>
<tr>
<td>2(b')</td>
<td>Determine the mixture TLV at 25°C and 1 atm pressure of a mixture derived from the following liquid:</td>
<td>[6]</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Component</th>
<th>Mole percent</th>
<th>Species TLV</th>
<th>P_{sat} (pascal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heptanes</td>
<td>65</td>
<td>400</td>
<td>6185.12</td>
</tr>
<tr>
<td>Toluene</td>
<td>35</td>
<td>50</td>
<td>3759.06</td>
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<tr>
<td></td>
<td></td>
<td></td>
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<tr>
<td><strong>2(c)</strong></td>
<td>Discuss in brief the concept of Occupational Health and Safety.</td>
<td>[3]</td>
<td></td>
</tr>
<tr>
<td><strong>3(a)</strong></td>
<td>What is HAZOP? Perform a HAZOP analysis on the reaction (A + B \rightarrow C) occurring in a batch reactor. The reaction is highly exothermic and the reaction temperature is controlled using cooling water circulating in the lighthouse of the batch reactor. The reaction can lead to run away condition.</td>
<td>[12]</td>
<td></td>
</tr>
<tr>
<td><strong>OR</strong></td>
<td></td>
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<td></td>
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<tr>
<td><strong>3(b)</strong></td>
<td>Discuss a case study of any major industrial accidental event with emphasis on the events that leads to incident.</td>
<td>[12]</td>
<td></td>
</tr>
<tr>
<td><strong>3(b)</strong></td>
<td>Discuss Response towards Emergencies for a worker and for an emergency team member.</td>
<td>[3]</td>
<td></td>
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<tr>
<td><strong>4(a)</strong></td>
<td>What are primary and secondary air pollutants? Also discuss various air pollutants along with their sources?</td>
<td>[3]</td>
<td></td>
</tr>
<tr>
<td><strong>4(b)</strong></td>
<td>Discuss vertical dispersion in the atmosphere using the air parcel concept according to the conditions prevailing in the atmosphere.</td>
<td>[6]</td>
<td></td>
</tr>
<tr>
<td><strong>4(c)</strong></td>
<td>Discuss various sampling techniques used in waste water analysis. Discuss wrinkle test and oxygen probe test for the measurement of dissolved oxygen along with the reactions.</td>
<td>[6]</td>
<td></td>
</tr>
</tbody>
</table>
2014 – 2015
B.TECH. (WINTER SEMESTER) EXAMINATION
(PETROCHEMICAL ENGINEERING)
FERTILIZER TECHNOLOGY
PK – 442 – A (DE – IV)
Credits : 04

Maximum Marks: 60

Note: Answer all questions.

1(a) What are Bio-fertilizers? Give examples. What are the advantages and limitations of Bio-fertilizers? [06]

OR

(a) Classify the elements essential for plant growth? Discuss the role of organic manure and chemical fertilizer. [06]

(b) Give examples of at least six fertilizers which provide macro-nutrients and also write down the approximate content of these nutrients. [04]

(c) Are we self sufficient in all types of Fertilizer production? Name few fertilizers which are produced in India. [05]

2(a) Develop and describe an integrated process flow sheet for the manufacture of Urea employing a gas mixture of N2 and H2 stream available in the ratio 1:3 and as feed stock. Discuss the problems associated with the Urea Plant and also suggest some process modifications. [09]

(b) Briefly explain the Contact process for the production of Sulphuric acid with a neat flow diagram. [06]

OR
(b) Draw and discuss a process flow sheet for the production of Synthesis gas from catalytic steam reforming process. Why this process can not be employed for heavier fractions.

3. (a) Though the chemical structure of triple super phosphate and super phosphate is same yet the content of \( \text{P}_2\text{O}_5 \) is three times why? Draw and describe the process flow diagram of TSP production. Discuss the main environmental issues associated with the plant.

OR

(a') What is the ammonia to phosphoric acid ratio in the preneutralizer and in the granulator for the production of Mono and Di-ammonium phosphate? Draw and discuss a neat process flow diagram for the production of Ammonium phosphate. With chemical reactions involved. Explain the control of reactor temperature.

(b) Explain briefly the manufacture of phosphoric acid. Employing we process with special reference to particle size.

4. (a) Differentiate between compounded fertilizer and Blended Fertilizers. Define Antagonism and Synergism of Fertilizer.

(b) Write the names of four straight Potash Fertilizers. Draw the flow sheet of the production of either sulphate of Potash or Potassium Nitrate.

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2014-15  
B.TECH. (AUTUMN SEMESTER) EXAMINATION  
PETROCHEMICAL ENGINEERING  
PROCESS UTILITIES AND ENERGY MANAGEMENT  
PK-422N

Maximum Marks: 60  
Credits: 04  
Duration: Three Hours

*Answer all the questions.*  
*Assume suitable data if missing.*  
*Notations used have their usual meaning.*

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<tr>
<th>Q.No.</th>
<th>Question</th>
<th>M.M.</th>
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<tr>
<td>1(a)</td>
<td>What is meant by the term Process Utility? Discuss its significance. How steam can be thought as an expensive utility.</td>
<td>[06]</td>
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<tr>
<td><strong>OR</strong></td>
<td></td>
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<tr>
<td>1(a’)</td>
<td>What is Sauter mean diameter? Discuss the classification of burners and explain the working of pressure jet atomizer.</td>
<td>[06]</td>
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<tr>
<td>1(b)</td>
<td>Discuss with the help of neat sketch the principle and working of Gas compression cycle.</td>
<td>[06]</td>
</tr>
<tr>
<td>1(c)</td>
<td>What is refrigeration? Write the chemical name and steps adopted in deduction of the formula for the following refrigerants: R13B1, R132bB2, R740 and R-C316</td>
<td>[03]</td>
</tr>
<tr>
<td>2(a)</td>
<td>Explain the generation of flash steam using T-S diagram. Why superheated steam cannot be used for process heating.</td>
<td>[06]</td>
</tr>
<tr>
<td>2(b)</td>
<td>What is steam trap? Discuss its classification.</td>
<td>[03]</td>
</tr>
<tr>
<td>2(c)</td>
<td>Discuss Base exchange and Lime Soda process for external water treatment process for boiler feed water.</td>
<td>[06]</td>
</tr>
</tbody>
</table>
3(a) Discuss the essential principles of Energy Management? Discuss the salient features of effective energy management program.

OR

3(a') What is Energy Audit? Discuss the procedure for performing Energy Audit.

3(b) For the stream data given in Table 1, construct hot and cold composite curves in graph paper (pinch analysis). With ΔT_{min} = 20 °C, find the minimum hot utility and minimum cold utility requirement.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Feed</td>
<td>60</td>
<td>205</td>
<td>20</td>
<td>2900</td>
</tr>
<tr>
<td>2</td>
<td>Reac. Out</td>
<td>270</td>
<td>160</td>
<td>18</td>
<td>1980</td>
</tr>
<tr>
<td>3</td>
<td>Product</td>
<td>220</td>
<td>70</td>
<td>35</td>
<td>5250</td>
</tr>
<tr>
<td>4</td>
<td>Recycle</td>
<td>160</td>
<td>210</td>
<td>50</td>
<td>2500</td>
</tr>
</tbody>
</table>

OR

3(b') What is Pinch Technology? State the steps in Pinch Analysis.

4(a) Discuss any five commercial waste heat recovery devices and explain their operating principles with help of diagrams.

OR

4(a') What is waste heat? Discuss the benefits of waste heat recovery.

5) Explain various types of recuperators.
2014-15
B.TECH. (WINTER SEMESTER) EXAMINATION
PETROCHEMICAL ENGINEERING
INDUSTRIAL INSTRUMENTATION
PK-427A

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No. Question M.M.
1(a) Explain the following terms with suitable examples; 10
(i). Primary sensing element,
(ii). Transducer
(iii). Final control element
(iv). Set point
(v). Error

1(b) Describe the selection criteria and precautions that must be taken into account while installing a pressure transducer in a process line. 5

OR

1* A LPG bottling plant needs automation for filling stations. The prescribed quantity of LPG may be determined either by pressure of gas inside the cylinder or by measuring the overall weight of filled cylinder. Which method you will prefer over other? Draw the control loop for your selected option. Justify your selection. 15

2(a). Explain the working of following with the help of neat and clean figures. 7.5
(i) Needle valve
(ii) Globe valve
(iii) Port guided valve

contd...2
2(b). Briefly describe the function of valve packing. [7.5]

3(a). Give the symbols for the following:
   (i) Process valves.
   (ii) Flow sensors.
   (iii) Valve failure mode. [7.5]

3(b). Explain the following diagram; [7.5]

OR

3'. Discuss the different type of conventional control loops in the process industry. [15]

4(a). Explain the following terms;
   (i) PLC, (ii) EEPROM, (iii) HMI [7.5]

4(b). Why the Distributed control system (DCS) is preferred for large scale process plant? [7.5]
   Explain with the help of neat line diagram.
B.TECH. (WINTER SEMESTER) EXAMINATION
PETROCHEMICAL ENGINEERING
PROCESS INSTRUMENTATION
PK-441A

Maximum Marks: 60
Credits: 04
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.  Question               M.M.
1(a)   Explain the followings;
       (i). Cold junction compensation in thermocouple
       (ii). Capacitive type Differential Pressure Transducer (DPT)
       (iii). construction and working of pH electrode
       (iv). Measures to be incorporated for high accuracy flow control

1(b)   (i). Drive the expression for flow rate in Venturimeter

OR

1' In a flow control loop flow is sensed by a venturimeter having cross sectional area of throat and upstream line as 2.5 and 10 cm². The differential pressure transducer (DPT) converters the pressure differential to electrical signal as per the calibration chart;

<table>
<thead>
<tr>
<th>Q (m³/s)</th>
<th>0.0</th>
<th>0.2</th>
<th>0.4</th>
<th>0.6</th>
<th>0.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>I (mA)</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>16</td>
<td>20</td>
</tr>
</tbody>
</table>

Find out the change in differential pressure across venturi for change in corresponding electrical current of 10 to 15 mA.

\( \rho_{\text{water}} = 1000 \text{kg/m}^3 \)

2(a) Explain the working of following with the help of a neat and clean figure.
   (i) Gate Valve
   (ii) Ball Valve

Contd....2.
2(b). Give a detailed description of pneumatic actuators including its working advantages and disadvantages etc.

3(a). Give symbols and significance for different types of lines, bubbles and process equipment.

3(b). Discuss SAMA Diagram and draw various symbols used in it.

OR

3'. Draw and discuss control loop diagram for hydrodealkylation Unit.


4(b). Discuss in detail the importance of Distributed Control System (DCS) in large scale Petrochemical plants. Compare the DSC system with dedicated PLC system.