

Total No. of Questions—8]

[Total No. of Printed Pages—4

Seat No.	
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[5667]-1004

F.E. (I Semester) EXAMINATION, 2019

ENGINEERING CHEMISTRY

(2019 PATTERN)

Time : 2½ Hours

Maximum Marks : 70

N.B. :— (i) Solve either Q. No. 1 or Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 and Q. No. 7 Or Q. No. 8.

(ii) Neat diagrams must be drawn wherever necessary.

(iii) Figures to the right indicate full marks.

(iv) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

(v) Assume suitable data, if necessary.

1. (a) Classify the composites on the basis of reinforcement. Give any *three* properties and application of polymer composites. [7]

(b) (i) Define quantum dots. Give any *two* properties of quantum dots. [3]

(ii) What are nanomaterials ? Give any *two* important applications of nanomaterials with example. [3]

P.T.O.

- (c) What is biodegradable polymer ? Explain the favourable conditions for biodegradation. Give any *two* applications of biodegradable polymer. [5]

Or

2. (a) What are carbon nanotubes ? Discuss the different types of carbon nanotubes with respect to their structure. Give any *three* applications of it. [7]
- (b) Give the structure, properties and applications of : [6]
- (i) Polycarbonate
- (ii) Polyphenylene vinylene (PPV).
- (c) Explain the structure of graphene with the help of diagram. Give any *three* applications of graphene. [5]
3. (a) (i) 0.5 gm of coal sample on complete combustion was found to increase the weight of CaCl_2 U-tube by 0.2 gm and KOH U-tube by 1.2 gm. Calculate % C and % H in the given coal sample. [4]
- (ii) Write chemical reaction for production of Biodiesel and give its any *two* advantages. [3]
- (b) Explain in brief the process with diagram for distillation of crude petroleum. Give composition, boiling range and uses of any *two* fractions obtained. [5]
- (c) Explain the production of hydrogen by steam reforming of methane and coke with reaction conditions. [5]

Or

4. (a) (i) On burning 0.84 gm of solid fuel in a bomb-calorimeter, the temperature of 3000 gm of water increased from 26.8°C to 29.6°C. Water equivalent and latent heat of steam are 380 gm and 587 cal/gm respectively. If the fuel contains 0.7% hydrogen, calculate its gross and net calorific value. [4]
- (ii) Define gross and net calorific value and justify the relationship between GCV and NCV of the fuel, if the fuel contains hydrogen. [3]
- (b) What is power alcohol ? Give any *three* merits and demerits of power alcohol. [5]
- (c) What is proximate analysis of coal ? Explain the procedure for determination of each constituent with its formula. [5]
5. (a) Give the principle, instrumentation and applications of UV-visible spectrophotometer. [7]
- (b) What are the conditions of absorption of IR radiations by the molecule. Draw a block diagram of IR spectrophotometer. Explain any *three* components of IR spectrophotometer with their functions. [6]
- (c) (i) State and give mathematical expression of Beers and Lambert's law. [3]
- (ii) Define the following : [2]
- (1) Chromophore
- (2) Bathochromic shift.

Or

6. (a) Give principle of IR spectroscopy. Explain modes of vibrations with stretching and bending vibrations. [7]
- (b) Explain different types of electronic transitions that occur in an organic molecule after absorbing UV-radiations. [6]
- (c) Explain any *five* applications of IR spectroscopy. [5]
7. (a) (i) Define oxidation corrosion. Explain general mechanism of oxidative corrosion. [4]
- (ii) What is galvanising ? Explain process with neat labelled diagram to protect iron from corrosion. [3]
- (b) Explain any *five* factors affecting corrosion on the basis of nature of metal. [5]
- (c) Define electroplating. Explain electroplating process with neat labelled diagram and applications. [5]

Or

8. (a) (i) What is principle of cathodic protection ? Explain it with any *one* suitable method. [4]
- (ii) Distinguish between anodic and cathodic coatings. [3]
- (b) What is Pilling-Bedworth ratio ? Give *four* types of oxide films formed on surface of metal with suitable example. [5]
- (c) Define corrosion. State the condition under which wet corrosion occurs. Explain hydrogen evolution mechanism of wet corrosion. [5]

OCT/FE/INSEM-3
F.E. (Phase - I)
ENGINEERING CHEMISTRY
(2019 Pattern)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) *Solve either Q.No.1 or Q.No.2 and Q.No. 3 or Q.No.4.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.*
- 5) *Assume suitable data if necessary.*

- Q1)** a) Describe Deionisation method of water softening with ion - exchange and regeneration reactions. [5]
- b) Explain the causes and give preventive measures of caustic embrittlement in boilers. [4]
- c) What is hardness of water? Define temporary and permanent hardness.[3]
- d) Water sample is not alkaline to phenolphthalein. However, 25 ml of this water sample on titration required 4.5ml 0.02 N HCl for methyl orange end point. Determine the type and amount of alkalinity present in water.[3]

OR

- Q2)** a) Define scales. Explain in brief four causes of deposit formation in boilers. [5]
- b) What is reverse osmosis? Describe the process with labelled diagram.[4]
- c) The hardness of 50000 litres of water sample was removed by passing it through a zeolite bed. The zeolite bed then required 200 liters of NaCl solution, containing 100 g / liter of NaCl for regeneration. Calculate the hardness of water sample. [3]
- d) 25 ml of water sample required 8.8 ml of 0.01M EDTA to reach the end – point . 25 ml of the same water sample after boiling and filtration required 6.5 ml of the same EDTA solution to reach the end - point . Calculate total and permanent hardness of the water sample. [3]

P.T.O.

- Q3)** a) Explain the three stages of pH metric titration between strong acid and strong base with titration curve and reaction. [5]
- b) What is a reference electrode? Explain the construction of calomel electrode with labelled diagram and give its representation. [4]
- c) Explain the construction of a conductivity cell with labelled diagram. [3]
- d) Give the composition of the membrane of the ion selective electrode used for the determination of H^+ , F^- and Cl^- . [3]

OR

- Q4)** a) Explain the three stages of conductometric titration between strong acid and strong base with titration curve and reaction. [5]
- b) What are Ion Selective Electrodes? Give the composition and working of enzyme based membrane for determination of urea, with figure. [4]
- c) Define the following terms and give their SI units. [3]
- i) Equivalent conductance
- ii) Specific conductance
- d) Which are the different types of buffer solutions? Give example of each type. [3]



Total No. of Questions : 4]

SEAT No. :

P3

[Total No. of Pages : 2

FE/Insem./APR - 3

F.E. (Semester - II)

107009 : ENGINEERING CHEMISTRY

(2019 Pattern)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) Solve either Q. No. 1. or Q. No. 2. and Q. No. 3. or Q. No. 4.
- 2) Neat diagrams must be drawn whenever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 5) Assume suitable data, if necessary.

Q1) a) Explain procedure for EDTA method of determining of total hardness of water sample. Draw metal EDTA complex and give chemical reactions involved. **[5]**

b) Explain causes, disadvantages and preventive measure of caustic embrittlement. **[4]**

c) Give exchange reactions of zeolite with following salt. **[3]**

i) $\text{Ca}(\text{HCO}_3)_2$ ii) MgCl_2 iii) CuSO_4

d) 100 ml of an alkaline water sample requires 5.2 ml of 0.02 M HCl up to phenolphthalein end point and 15.8 ml for methyl orange end point. Find the type and amount of alkalinity in water sample. **[3]**

OR

Q2) a) Describe deionization method with figure, process, ion exchange reactions for softening of hard water **[5]**

b) What is priming and foaming? Give any three disadvantages of priming and foaming. **[4]**

c) 50 ml of water sample require 18 ml of 0.05 M EDTA during titration. Whereas 50 ml of boiled water sample, require 12.5 ml of same EDTA in the titration. Calculate total, temporary and permanent hardness of water sample. **[3]**

P.T.O.

- d) A zeolite bed exhausted by softening 4000 lit. of water requires 10 litres of 15% NaCl solution for regeneration calculate the hardness of water sample. [3]

Q3) a) What is reference electrode? Give construction of calomel electrode with labelled diagram and its representation. [5]

- b) What are ion selective electrode? Discuss the composition and working with labelled diagram of fluoride ion selective electrode. [4]

c) Define the following terms:- [3]

- i) Specific conductance
- ii) Cell constant
- iii) Equivalent conductance

- d) Give the procedure for standardisation of PH^- meter. [3]

OR

Q4) a) Draw and explain the various stages of PH metric titration curve for the titration of HCl Vs NaOH. Give the reactions involved in it. [5]

- b) Give the constructions of glass electrode with labelled diagram, its representation and applications. [4]

c) Explain why [3]

- i) In weak acid and weak base conductometric titration the conductance remains nearly constant after equivalence point.
- ii) In conductometric titration of weak acid and strong base the conductance increases till equivalence point.

- d) Explain the construction of conductivity cell with labelled diagram. [3]

Total No. of Questions : 9]

SEAT No. :

P6487

[Total No. of Pages : 4

[5868]-103

F.E. (Semester - I & II)
ENGINEERING CHEMISTRY
(2019 Pattern) (Paper - II) (107009)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Questions No. 1 is compulsory. Solve Q.No. 2 or Q.No. 3, Q.No. 4 or Q.No. 5, Q.No. 6 or Q.No. 7 and Q.No. 8 or Q.No. 9.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicates full marks.
- 4) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 5) Assume suitable data if necessary.

Q1) Multiple choice questions -

- i) PPV shows _____ fluorescence on application of electric field and can be used in _____ [2]
A) blue, sutures B) yellow-green, organic LEDs
C) red, eye-wear lenses D) violet, drug - delivery
- ii) C atoms in graphene show _____ hybridisation. [1]
A) sp^3 B) sp
C) sp^2 D) sp^3d^2
- iii) Power alcohol is advantageous because it _____ [1]
A) decreases octane number B) burns clean
C) increases calorific value D) increases cetane number
- iv) Units of calorific value are _____ [1]
A) Cal/g B) Cal/m
C) Joules D) Kg/m^3

P.T.O.

- v) CO_2 is _____ and shows _____ fundamental modes of vibration. [2]
- A) linear, 3 B) non-linear, 3
- C) linear, 4 D) non-linear, 4
- vi) Electromagnetic radiations with wavelength 10-400 nm are called _____ radiations. [1]
- A) Visible B) Microwave
- C) IR D) Ultra violet
- vii) Tinning is coating of _____. [1]
- A) Fe on Sn B) Zn on Fe
- C) Sn on Fe D) Fe on Zn
- viii) Rate of corrosion _____ with increase in purity of the metal. [1]
- A) decreases
- B) increases
- C) remains same
- D) initially increases and then remains constant

OR

Q4) a) What is proximate analysis of coal? Give the procedure and formula for determination of each constituent. [6]

b) Explain the production of hydrogen by steam reforming of coke and methane with reaction conditions. [5]

c) The following data was obtained in a Boy's gas

Calorimeter experiment -

Volume of gas burnt at STP = 0.1m^3

Mass of cooling water = 30 kg

Rise in temperature of cooling water = 8.1°C

Mass of steam condensed = 0.08 kg

Calculate GCV and NCV of the fuel [4]

OR

Q5) a) Give the principle and explain the process of fractional distillation of crude oil with labelled diagram. Give the composition and boiling range of any one fraction obtained during refining. [6]

b) Give the preparation reaction of biodiesel. State four advantages and two limitations of biodiesel. [5]

c) 1.0g of coal sample on complete combustion increased the weight of U-tube containing CaCl_2 by 0.5g and tube containing KOH by 2.4g. Calculate % of C and H in the given coal sample. [4]

Q6) a) Draw block diagram of IR spectrophotometer. Explain its any four components and give their function. [6]

b) Explain the possible transitions which occur on absorption of UV-Vis radiations by an organic molecule. [5]

c) Explain any four applications of IR spectroscopy. [4]

OR

Q7) a) Draw block diagram of single beam UV-vis spectrophotometer. Explain its four components and give their function. [6]

b) Give the principle of IR spectroscopy. Explain fundamental modes of bending vibrations. [5]

- c) Define the following terms - [4]
- i) Chromophore
 - ii) Hypsochromic shift
 - iii) Auxochrome
 - iv) Hypochromic shift

- Q8)** a) Explain hydrogen evolution and oxygen absorption mechanism of wet corrosion. [6]
- b) What is electroplating? Explain the process with diagram and reactions. Give applications of electroplating. [5]
- c) What are anodic and cathodic coatings? Which are better and why? [4]

OR

- Q9)** a) State Pilling Bedworth ratio and give its significance. Give the different types of oxide films with suitable example formed during the oxidation corrosion of metals. [6]
- b) Explain any five factors affecting the rate of corrosion. [5]
- c) What is the principle of cathodic protection? Explain any one method of cathodic protection. [4]



Total No. of Questions : 4]

SEAT No. :

PA-1680

[Total No. of Pages : 2

[5931]-1003

F.E.

ENGINEERING CHEMISTRY
(2019 Pattern) (107009)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) Neat diagrams must be drawn wherever necessary.
- 2) Figures to the right indicate full marks.
- 3) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 4) Assume Suitable data if necessary.
- 5) Answer Question No. Q1 or Q2, Q3 or Q4.

- Q1)** a) What is EDTA? Give its structure. Explain the process for water hardness determination using EDTA with reactions. [5]
- b) Explain boiler corrosion due to dissolved gases oxygen and carbon dioxide with reactions. [4]
- c) 100mL water consumed 5.2mL, 0.02M HCl up to phenol phthalein in end point and 15.8mL at methyl orange end point in titration. Find amount and types of alkalinity in water. [3]
- d) What are zeolites? Give reactions for : [3]
- i) Removal of Ca^{++} and Mg^{++}
 - ii) Regeneration of exhausted zeolite.

OR

- Q2)** a) Define scales. Give any four causes of scale formation in boiler. [5]
- b) Explain process of reverse osmosis for separation of salts from water with neat labeled diagram. [4]
- c) 50mL water sample required 18mL 0.05M EDTA in a hardness determination experiment. Whereas 50mL of the same water after boiling consumed 9mL 0.05M EDTA. Calculate Total, Permanent and temporary Hardness of water sample. [3]
- d) A zeolite bed exhausted by softening 4000 liter of water requires 10 liters of 15% NaCl solution for regeneration. Calculate hardness of water. [3]

P.T.O.

Q3) a) Explain three stages of pH metry titration between HCl & NaOH with titration curve and reactions. [5]

b) Give construction working with diagram of glass electrode. [4]

c) Give composition of membrane of ion selective Electrode used to detect [3]

i) H^+

ii) F^-

iii) Cl^-

d) Define: i) Equivalent conductance

ii) Molar conductance

iii) Cell constant

[3]

OR

Q4) a) Explain conductometry Titration curve for neutralization of strong acid using strong base with reactions. [5]

b) Give construction, working with neat labeled diagram of calomel Electrode. [4]

c) Write any two advantages of instrumental methods of analysis. Give stepwise process for calibration of a pH-meter. [3]

d) What is a buffer solution? Give its types with example each. [3]



Total No. of Questions : 9]

SEAT No. :

P-9068

[Total No. of Pages : 4

[6178]-3

E.E.

ENGINEERING CHEMISTRY
(2019 Course) (Semester - I / II) (107009)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Q. No. 1 is compulsory. Solve Q. No. 2 or Q. No. 3, Q. No. 4 or Q. No. 5, Q. No. 6 or Q. No. 7, Q. No. 8 or Q. No. 9.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Assume suitable data, if necessary.
- 5) Use of logarithmic tables slide rule, Mollier electronic pocket calculator and steam tables is allowed.

Q1) Multiple Choice Questions :

- a) Which of the following is used for p-doping in conducting polymers? [1]
 - i) Lithium
 - ii) Iodine
 - iii) Sodium
 - iv) Calcium
- b) Electroluminescent polymers are used in _____. [1]
 - i) LED
 - ii) Sutures
 - iii) Safety goggles
 - iv) Rechargeable batteries
- c) Which among the following is an example of quantum dots? [1]
 - i) Se
 - ii) K
 - iii) CdSe
 - iv) AsF₅
- d) Unit of calorific value for solid fuel is _____. [1]
 - i) Kcal/m³
 - ii) cal/g
 - iii) Joules
 - iv) J/m³
- e) The enzyme used for conversion of glucose to ethanol is _____. [1]
 - i) lactase
 - ii) maltase
 - iii) invertase
 - iv) zymase

P.T.O.

- f) Electromagnetic radiations with wavelength 10 to 400 nm are called as _____ radiations. [1]
- i) Visible ii) IR
iii) X-ray iv) UV
- g) According to Beer's law _____. [1]
- i) $A \propto x$ ii) $A \propto c$
iii) $A = -\log 1/T$ iv) $A = -\log T$
- h) _____ is used as a source of light in UV-vis spectrophotometer. [1]
- i) Nernst filament ii) Globar
iii) Tungsten lamp iv) Mercury arc
- i) Galvanisation is coating of _____. [1]
- i) Fe on Zn ii) Sn on Zn
iii) Sn on Fe iv) Zn on Fe
- j) Pilling Bedworth ratio gives an idea regarding _____. [1]
- i) rate of combustion ii) quality of fuel
iii) amount of light absorbed iv) nature of oxide film formed

OR

- Q4) a)** Discuss the construction and working of Bomb calorimeter with diagram for determination of GCV of fuel. State the formula (without corrections) to calculate GCV. [6]
- b)** Give the preparation reaction of biodiesel. Give its four advantages and two disadvantages. [5]
- c)** 1.2g of coal sample on complete combustion increased the weight of U-tube containing CaCl_2 by 0.7g and U-tube containing KOH by 2.5g. Calculate % C, % H in coal. [4]

OR

- Q5) a)** State the principle and explain the process of fractional distillation of petroleum with diagram. Give the composition, boiling range and application of any one fraction obtained. [6]
- b)** Explain production of hydrogen by steam reforming of methane and coke with reaction conditions. [5]
- c)** 1.0 g of coal sample was heated for 1 hr. at $105-110^\circ\text{C}$, weight of the residue obtained was 0.9 g. The crucible was then heated without lid till a constant weight of 0.15 g was obtained. In an another experiment, 1.0g of the same coal sample was taken in a crucible with a vented lid and heated at 925°C for 7 minutes. The weight of the residue was 0.55 g. Calculate % moisture, % volatile matter, % ash and % fixed carbon. [4]
- Q6) a)** What are the conditions of absorption of IR radiations by molecules? Explain the fundamental modes of bending vibrations. [6]
- b)** Discuss any five applications of UV-vis spectroscopy. [5]
- c)** Define : [4]
- | | |
|----------------------|-----------------|
| i) Hypochromic shift | ii) Chromophore |
| iii) Red shift | iv) Blue shift |

OR

- Q7) a)** Explain the different types of electronic transitions with diagram which occur on absorption of UV-vis radiations by an organic molecule. State the forbidden transitions. [6]
- b)** Draw block diagram of IR spectrophotometer. Explain and give function of its four components. [5]
- c)** Calculate fundamental modes of vibrations for - [4]
- | | |
|--------------------|-------------------|
| i) NO | ii) CH_4 |
| iii) NH_3 | iv) CO_2 |

- Q8)** a) Give the reaction involved and mention the type of oxide film formed on the oxidation corrosion of Na, Mg, Cr, Mo. [6]
- b) What is electroplating? Explain the process with diagram and reactions involved. Give any two applications of electroplating. [5]
- c) Define cathodic and anodic coatings. Which are better and why? [4]

OR

- Q9)** a) Explain hydrogen evolution and oxygen absorption mechanisms of wet corrosion. [6]
- b) Discuss any five factors w.r.t. nature of metal affecting rate of corrosion. [5]
- c) Give the principle of cathodic protection. Explain any one method of cathodic protection. [4]



Total No. of Questions : 4]

SEAT No. :

P-5369

[Total No. of Pages : 2

[6185]-52
F.E. (Insem.)
ENGINEERING CHEMISTRY
(2019 Pattern) (Semester-I) (107009)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates :

- 1) Solve Q1 or Q2, Q3 or Q4.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right side indicate full marks.
- 4) Use of logarithmic tables rule, Mollier chart, electronic pocket calculator and steam is allowed.
- 5) Assume suitable data, if necessary.

- Q1)** a) What is EDTA? Give its structure. Explain the process for water hardness determination using EDTA with reactions. **[5]**
- b) Explain reverse osmosis process with figure advantages and applications. **[4]**
- c) Define caustic embrittlement. Give causes and prevention of caustic embrittlement. **[3]**
- d) An exhausted zeolite was regenerated by 150 litre of NaCl having strength 150gm/liter. How many liters of Hard water having Hardness 400 ppm as CaCO_3 can be softened by this softener? **[3]**

OR

- Q2)** a) Draw neat and labelled diagram of demineralization method give ion exchange and regeneration reaction of water containing CaCl_2 . **[5]**
- b) Define the following terms. **[4]**
- i) Scale
 - ii) Sludge
 - iii) Priming
 - iv) Foaming
- c) 100ml of an alkaline water sample requires 5.2ml of N/50 Hcl upto phenolphthalein end point and 15.8ml for methyl orange end point. Find the type and amount of alkalinity in water sample. **[3]**
- d) 50ml of water sample requires 15ml of 0.02M EDTA during titration. Whereas 50ml boiled water sample requires 11ml of same EDTA in the titration. Calculate total, Temporary and permanent Hardness of water sample. **[3]**

P.T.O.

- Q3)** a) What is reference electrode? Give construction of calomel electrode with labelled diagram and its representation. [5]
- b) What are ion selective electrode? Give composition of membrane of ion selective electrode used to detect H^+ , F^- and Cl^- ions. [4]
- c) Explain any three factors affecting the conductivity. [3]
- d) What is Buffer solution? Explain the types with example. [3]

OR

- Q4)** a) Explain pH metric titration of HCl against NaOH, with procedure, titration curve and calculations. [5]
- b) Give construction with neat labelled diagram and representation of glass electrode. [4]
- c) Define the following terms: [3]
- i) Specific conductance
 - ii) Equivalent conductance
 - iii) Molar conductance
- d) What is conductometric titration? Give the reaction and draw the titration curve for conductometric titration between strong acid against strong base. [3]



Total No. of Questions : 4]

PC375

SEAT No. :

[Total No. of Pages : 2

[6358]-103

F.E. (Insem)

ENGINEERING CHEMISTRY
(2019 Pattern) (Semester - I) (107009)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) Answer Q.1 or Q.2, Q.3 or Q.4.
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Figures to the right indicate full marks.
- 4) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 5) Assume suitable data, if necessary.

- Q1)** a) Explain zeolite process of softening of water, with figure, process and reactions. [5]
- b) What is priming and foaming? Give causes, disadvantages and prevention of priming and foaming. [4]
- c) What are different types of impurities in water. Explain any two in detail. [3]
- d) 100 ml of alkaline water sample requires 5.8 ml of 0.02 N HCl upto phenolphthalein end point and 14.2 ml upto methyl orange end point. Find the types and amount of alkalinities in water sample. [3]

OR

- Q2)** a) Give the causes, disadvantages and preventions of scale formation in boilers. [5]
- b) Define Desalination of water. Explain reverse osmosis process for desalination of water with neat labelled diagram. [4]
- c) Give any two exchanging reactions and regeneration reactions of ion exchange/Demineralisation process. [3]
- d) 50 ml of water sample requires 15 ml of 0.02 N EDTA during titration. Whereas 50 ml of boiled water sample requires 11 ml of same EDTA in the titration. Calculate total, temporary and permanent hardness of water sample. [3]

P.T.O.

- Q3)** a) Explain pH metric titration of strong acid against strong base, with procedure, titration curve and calculations. [5]
- b) What are ion selective electrodes? Give composition and working of enzyme based membrane electrode for determination of urea. [4]
- c) Explain the conductometric titration with reaction and titration curve before and after equivalence point of strong acid-strong base. [3]
- d) What is Buffer solution? Explain the types with example. [3]

OR

- Q4)** a) Explain construction, working of conductivity cell used in the conductometric titrations with suitable diagram. [5]
- b) What is the reference electrode? Draw neat labelled diagram of Calomel electrode and give its cell representation with two demerits. [4]
- c) Define following terms [3]
- i) Specific conductance
 - ii) Equivalent conductance
 - iii) Cell constant
- d) Explain the conductometric titration of weak acid Vs. Weak base with two stages and titration curve. [3]



Total No. of Questions : 4]

SEAT No. :

PB2

[Total No. of Pages : 2

[6267] 2

F.E. (All Branches) (Insem)
ENGINEERING CHEMISTRY
(2019 Pattern) (Semester - II) (107009)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates:

- 1) Answer Q1 or Q2 and Q3 or Q4.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 5) Assume suitable data, if necessary.

- Q1)** a) Define scales. Explain four causes of deposit formation in boilers. [5]
- b) Give the ion-exchange and regeneration reactions involved in the deionisation of water containing $MgCl_2$. [4]
- c) Define : [3]
- i) Permanent hardness
 - ii) Foaming
 - iii) Caustic embrittlement
- d) 25 ml. of hard water sample required 11.2ml of 0.01MEDTA to reach the end-point. 25ml of the same water sample after boiling and filtrations required 7.9ml of the same EDTA to reach the end-point. Calculate total, temporary and permanent hardness of water. [3]

OR

- Q2)** a) Define hardness. Give the structure of Na_2EDTA . Explain the EDTA method for determination of total hardness of water with reactions and formula. [5]
- b) What is reverse osmosis? Explain the process of reverse osmosis with figure. [4]

P.T.O.

- c) 50 ml. of alkaline water required 5.7 ml of 0.02 N HCl to reach the phenolphthalein end-point and further 5.7 ml of the same acid to reach the methyl orange end-point. Calculate the type and amount of alkalinity of water. [3]
- d) A zeolite bed was exhausted by passing 5100 lit. of hard water. It required 120 lit. of brine containing 15g/lit. of NaCl for regeneration. Calculate the hardness of water. [3]

- Q3)** a) Explain the three stages of PH metric titration between strong acid and strong base. Give the reaction and draw the titration curve. [5]
- b) What are ion-selective electrodes? Give the composition of the ISE membrane for determination of F^- , Cl^- and urea. [4]
- c) Give construction with neat, labelled diagram and representation of glass electrode. [3]
- d) Explain the construction of conductivity cell with neat labelled diagram. [3]

OR

- Q4)** a) Explain the three stages of conductometric titration between CH_3COOH and NH_4OH with titration curve and reaction. [5]
- b) Define the following terms. [4]
- Specific conductance
 - Reference electrode
 - Molar conductance
 - Buffer
- c) Explain why : [3]
- In pH metric titration of HCl against NaOH the pH at equivalence point is 7.
 - In conductometric titration of HCl vs NaOH the conductance decreases rapidly till equivalence point.
- d) Which electrodes are used in pH metric titration of HCl vs NaOH? Give the procedure for calibration of pH meter. [3]



Total No. of Questions : 9]

SEAT No. :

PB-3589

[Total No. of Pages : 4

[6260]-4

F.E.

ENGINEERING CHEMISTRY
(2019 Pattern) (Semester - I/II) (107009)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Question No. 1 is compulsory.
- 2) Solve any one of Q2 or Q3, Q4 or Q5, Q6 or Q7, Q8 or Q9.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of logarithmic table slide rule, molar charts, electronic pocket calculator and steam tables is allowed.
- 6) Assume Suitable data, if necessary.

Q1) Multiple Choice Questions :

[10]

- i) CDs, DVDs can be made from -
 - a) Polycarbonate
 - b) Polypropylene
 - c) Polyacetylene
 - d) Kevlar
- ii) Matrix phase in a composite is formed by -
 - a) Fibers
 - b) Particulates
 - c) Polymer
 - d) Flakes
- iii) Which of the following is used for N-doping in conducting polymers -
 - a) Iodine
 - b) Chloride
 - c) Sodium
 - d) Fluoride
- iv) $NCV = GCV - \text{_____} \times 587 \text{ kcal/kg}$
 - a) 0.90H
 - b) 9.0H
 - c) 0.9H
 - d) 0.09H

P.T.O.

- v) Cooling correction should be _____ during calculation of GCV of a fuel by bomb calorimeter, correctly
- added
 - subtracted
 - multiplied
 - neglected
- vi) According to Lambert's law
- $A \propto x$
 - $A \propto c$
 - $A = -\log \frac{1}{T}$
 - $A = -\log T$
- vii) Which of the following is a chromophore
- $C = C$
 - $C - OH$
 - $C - NH_2$
 - $C - Br$
- viii) The possible number of fundamental mode of vibration in case of H_2O molecule is
- 2
 - 3
 - 4
 - 5
- ix) Rate of corrosion _____ with decrease in pH of metal
- Decrease
 - Increase
 - Remain same
 - Initially increase and then remain constant
- x) Corrosion between the dissimilar metal is called as -
- Galvanic corrosion
 - Dry corrosion
 - Concentration corrosion
 - Oxidation corrosion
- Q2) a) What are biodegradable polymer. Explain three factors responsible for biodegradation. Give the structure of PHBV and its application. [6]
- b) Define nanomaterials. How are nanomaterial classified on the basis of dimension? Give example of each. [5]
- c) What are Quantum dots? Give properties and application of quantum dots. [4]

OR

- Q3) a)** What is conducting polymer? Explain intrinsically and extrinsically conducting polymer with example. how the conductivity of trans polyacetylene can be improved? [6]
- b) Explain structure of graphene with diagram. Give its four application. [5]
- c) Give structure, properties and applications of PPV as an electroluminiscent polymer. [4]

- Q4) a)** Explain steam reforming of coke and methane with reaction conditions for industrial production of hydrogen. Give process of CO₂ removal. [6]
- b) Give the principle of fractional distillation of petroleum crude with diagram. Write composition and boiling range and use of any one fraction obtained during refining of petroleum. [5]
- c) The following observations were noted in the Boy's gas calorimeter experiments - [4]

Volume of gas burnt at STP = 0.15 m³

Mass of cooling water used = 27 kg

Temperature of Inlet water = 24.1°C

Temperature of outlet water = 29.8°C

Mass of steam condensed = 0.04 kg

Find GCV and NCV of the fuel

OR

- Q5) a)** Draw net labeled diagram with principle of Bomb calorimeter. Give construction and working of Bomb calorimeter to determine GCV of a fuel. State the formula of GCV. [6]
- b) What is power Alcohol. Give procedure for preparation of ethanol with reaction. Give any two advantages of power alcohol. [5]
- c) A sample of coal was analysed as follows - Exactly 1.50 gm coal sample was heated for 1 hr at 105–110°C, the residue weight 1.435 gm. The crucible next was covered with a vented lid and strongly heated for exactly 7 min at 950° ± 20°C. The residue weight 1.027 gm. The crucible was then heated without cover, until a constant weight was obtained. The last residue was found to weight 0.117 gm. Calculate the percentage results of above analysis. [4]

- Q6)** a) Give the principle of IR spectrophotometer with help of block diagram. Explain any four application of IR spectroscopy. [6]
b) Explain mode of vibration with stretching and bending vibrations. [5]
c) Define - [4]
i) Hypochromic shift ii) Bathochromic shift
iii) Beer's law iv) Chromophore

OR

- Q7)** a) Explain different types of electronic transitions with diagram which occurs an absorption of uv-visible radiations by an organic molecule. State the forbidden transition. [6]
b) Give any five application of uv-visible spectroscopy. [5]
c) What are conditions of absorption of IR radiations by the molecule. [4]
- Q8)** a) Explain Hydrogen evolution and oxygen absorption mechanism of wet corrosion. [6]
b) Explain cathodic protection method using sacrificial anode with respect to principle diagram, method and applications. [5]
c) Discuss any four factors w.r.t. nature of metal affecting rate of corrosion. [4]

OR

- Q9)** a) State the pilling-Bedworth Ratio with their significance. Give reaction involved and mention the type of oxide film formed on the oxidation corrosion of Fe, Al, Ag and Mo. [6]
b) What is galvanization? Explain process with diagram. Give any two application of galvanization. [5]
c) Distinguish between anodic and cathodic coating. [4]

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PE898

F.E.

ENGINEERING CHEMISTRY

(2019 Pattern) (Credit System) (Semester - I/II) (107009)

[Max. Marks : 70

- 1) **Question No.1 is compulsory. Solve Q.No.2 or Q.No.3, Q.No.4 or Q.No.5, Q.No.6 or Q.No.7, Q.No.8 or Q.No.9.**
- 2) **Neat diagrams must be drawn wherever necessary.**
- 3) **Figures to the right indicate full marks.**
- 4) **Use of logarithmic tables, slide rules, Mollier charts, Use of scientific calculator is allowed.**
- 5) **Assume suitable data, if necessary.**

Q1) Multiple Choice Questions.

- i) All the carbon atoms in Graphene are _____ hybridized. [1]
 - a) SP
 - b) SP²
 - c) SP³
 - d) None of these
- ii) PHBV a copolymer is an example of _____ polymer. [1]
 - a) Biodegradable
 - b) Composite
 - c) Engg. Thermoplastic
 - d) Liquid Crystal
- iii) Reinforcing agent used in a polymer matrix _____. [1]
 - a) Carbon fibre
 - b) Glass fibre
 - c) Aramid fibre
 - d) All of these
- iv) Characteristics of a good fuel _____. [1]
 - a) High calorific value
 - b) Moderate ignition temp
 - c) Low Moisture content
 - d) All of the above
- v) Boy's calorimeter can be used to determine calorific value of _____. [1]
 - a) Solid fuel
 - b) Volatile liq fuel
 - c) Gaseous fuel
 - d) Both B & C
- vi) Fundamental modes of vibration in C₆H₆ are _____. [1]
 - a) 9
 - b) 6
 - c) 3
 - d) 30

P.T.O.

- Q5)** a) Explain the production of hydrogen by steam reforming of methane and coke with reaction conditions and removal of CO_2 . [6]
 b) What is Biodiesel? Give preparation reaction of biodiesel with reaction conditions give advantages and limitations of biodiesel. [5]
 c) 2.00g of coal sample was heated for one hour at 110°C , the weight of the residue was 1.80g. The residue was then covered with a vented lid and heated for exactly 7 minutes at 950°C . The residue weighed 1.00g. The crucible was then heated without lid till a constant weight of the residue of 0.15g was obtained. Calculate % of the various constituents of coal. [4]

- Q6)** a) Explain block diagram of single beam of UV-vis spectrophotometer. Explain its four components and give their function. [6]
 b) What are the conditions of IR radiations by the molecule? Calculate the fundamental modes of vibrations in the following molecules [5]
 i) H_2O
 ii) NO
 c) Define the following: [4]
 i) Beers law
 ii) Chromophore
 iii) Auxochrome
 iv) Bathochromic shift

OR

- Q7)** a) Give principle of IR spectroscopy. Explain modes of vibrations with stretching and bending vibrations. [6]
 b) Explain the possible electronic transitions with diagram which occur on absorption of UV. vis radiations by an org. molecule. [5]
 c) Explain any four applications of IR spectroscopy. [4]

- Q8)** a) Define corrosion. State the conditions under which wet corrosion occurs. Explain hydrogen evolution mechanism of wet corrosion. [6]
 b) What is the principle of cathodic protection? Explain any one method. [5]
 c) Explain any four factors affecting the rate of corrosion related to metal. [4]

OR

- Q9)** a) Define Electroplating. Explain the process with diagram and reactions. Give any two applications of electroplating. [6]
 b) What is PBR? Explain diff-types of films with related to nature of metal [5]
 i) Mg
 ii) Cu
 iii) Ag
 iv) Mo
 c) Distinguish between Galvanisation and Tinning. [4]

* * *

Total No. of Questions : 4]

SEAT No. :

PE-522

[Total No. of Pages : 2

[6577]-3
F.E. (Insem.)
ENGINEERING CHEMISTRY
(2019 Pattern) (Semester - I) (107009)

Time : 1 Hour]

[Max. Marks : 30

Instructions to the candidates :

- 1) Attempt Q.1 or Q.2 and Q.3 or Q.4.
- 2) Figures to the right indicate full marks.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.
- 5) Assume suitable data, if necessary.

- Q1) a)** Draw block diagram of Deionisation method. Give ion exchange and regeneration reactions of any one hardness causing salt. **[5]**
- b) Explain causes, any two disadvantages and any two preventive measures of caustic embrittlement. **[4]**
- c) Define the following : **[3]**
- i) Sludge
 - ii) Temporary hardness
 - iii) Electrodialysis
- d) The hardness of 50,000 liters of a water sample was removed by passing it through a zeolite softener. The softener then required 200 liters of NaCl solution containing 125 gm/lit of NaCl for regeneration. Calculate the hardness of water sample. **[3]**

OR

- Q2) a)** Define scale. Give any four causes of scale formation in boiler. **[5]**
- b) What is Reverse Osmosis? Describe the process with neat labelled diagram. **[4]**
- c) 50 ml of water sample requires 15 ml of 0.02 M EDTA during titration where as, 50 ml of boiled water sample requires 11 ml of same EDTA in the titration. Calculate total, permanent & temporary hardness of water. **[3]**
- d) Water is not alkaline to phenolphthalein. However, 100 ml of water sample on titration with N/50 H_2SO_4 required 16.5 ml for methyl orange end point. Determine the type and amount of alkalinity present in water. **[3]**

P.T.O.

- Q3)** a) Explain three stages of pH metry titration between HCl and NaOH with titration curve and reactions. [5]
- b) Give the construction of glass electrode with labelled diagram, its representation and applications. [4]
- c) What are the types of buffer solutions? Give example of each type. [3]
- d) Define the following terms : [3]
- i) Cell constant
 - ii) Molar conductance
 - iii) Equivalent conductance

OR

- Q4)** a) What is Ion selective Electrode. Give the composition and working of enzyme based membrane for urea determination with diagram. [5]
- b) What is reference electrode? Explain the construction of calomel electrode with labelled diagram and its representation. [4]
- c) Explain the construction of a conductivity cell with labelled diagram. [3]
- d) Draw conductometric titration curve of : [3]
- i) Strong Acid & strong Base
 - ii) Strong Acid & weak Base
 - iii) Weak Acid & strong Base

Total No. of Questions : 9]

SEAT No. :

PD4027

[6401]-1904

[Total No. of Pages : 4

F.E.

ENGINEERING CHEMISTRY

(2019 Pattern) (Credit System) (Semester - I/II) (107009)

Time : 2½ Hours]

[Max. Marks : 70

Instructions to the candidates:

- 1) Q.1 is compulsory.
- 2) Attempt 2 or 3, 4 or 5 6 or 7 & 8 or 9.
- 3) Neat diagrams must be drawn wherever necessary.
- 4) Figures to the right indicate full marks.
- 5) Use of logarithmic tables slide rule, mollier charts, electronic pocket calculator and steam tables is allowed.
- 6) Assume suitable data, if necessary.

Q1) Multiple choice questions:

[10]

- a) Poly Phenylene Vinylene (PPV) shows the property of.
 - i) Bioluminescence
 - ii) Luminescence
 - iii) Chemiluminescence
 - iv) Electroluminescence
- b) P-doping of conducting polymer is done by
 - i) I_2
 - ii) Na
 - iii) Li
 - iv) $SnCl_2$
- c) Nanomaterials are the materials in which size of particles ranges from
 - i) 1 nm - 100 nm
 - ii) 1 cm - 100 cm
 - iii) 1 mm - 100 mm
 - iv) 1 m - 100 m
- d) Catalyst used in shift reaction of H_2 production is
 - i) FeO
 - ii) Ni
 - iii) CH_3ONa
 - iv) None of these
- e) The relation between Gross and Net calorific value is
 - i) $GCV = NCV$
 - ii) $GCV > NCV$
 - iii) $GCV < NCV$
 - iv) None of these
- f) The detector used in UV-Visible spectrophotometer is
 - i) Phototube
 - ii) Photomultiplier tube
 - iii) Photovoltaic cell
 - iv) All of these

P.T.O.

- g) If absorption of molecule is shifted to wards longer wave length due to solvent effect is called as
- i) Hypsochromic shift ii) Hypochromic shift
 - iii) Bathochromic shift iv) Hyperchromic shift
- h) Bending vibrations are characterised by
- i) Change in bond angle between two covalent bonds
 - ii) Change in bond lenght between two covalent bonds
 - iii) Change in geometry of molecule
 - iv) No any change
- i) Galvanising is coating of
- i) Fe on Sn ii) Zn on Fe
 - iii) Sn on Fe iv) Fe on Zn
- j) Which type of reaction occur in anodic areas
- i) Oxidation ii) Reduction
 - iii) Displacement iv) Addition

Q2) a) What are Biodegradable polymers? Give the structure of PHBV. Explain three factors responsible for biodegradation. Give its any two applications. **[6]**

b) What are carbon nanotubes? Discuss the different types of carbon nanotubes with respect to their structure. Give any two applications. **[5]**

c) Give the structure, any two properties and two applications of polycarbonate. **[4]**

OR

Q3) a) Explain the structure of Graphene with the help of diagram and mention three properties and three applications. **[6]**

b) Define polymer composites. What is the role of matrix phase and disperse phase in composites. Give any two advantages. **[5]**

c) What are nanomaterials. Classify any three on the basis of dimensions. **[4]**

- Q4)** a) Give construction with figure, working and give corrected formula for finding gross calorific value of a solid fuel by Bomb calorimeter. [6]
 b) Give the preparation on reaction of Biodiesel. State three advantages of biodiesel. [5]
 c) 1.5 gm of coal sample in kjeldhal's experiment, librated ammonia which was absorbed in 25/ml 0.1N H_2SO_4 . The resultant solution required 14ml of 0.1N NaOH for complete neutralisation of H_2SO_4 . In back titration. The reading of blank titration was 25ml. Find the percent of nitrogen in coal. [4]

OR

- Q5)** a) Explain in brief the process with diagram for distillation of crude petroleum. Give composition, boiling range and uses of any two fractions obtained. [6]
 b) What is Power alcohol? Give any three merits and three demerits of power alcohol. [5]
 c) The following data was obtained in Boy's Jas calorimeter experiment. [4]
 i) Volume of gas burat at STP = $0.12m^3$
 ii) Mass of cooling water = 32kg
 iii) Rise in temperature of water = $7.8^\circ C$
 iv) Mass of steam condensed = 0.09kg
 Calculate GCV and NCV of the fuel

- Q6)** a) Draw the block diagram of IR spectrophotometer. Explain its four components and give their function. [6]
 b) Explain the possible electronic transitions that occure in the molecule after absorption of UV radiations with suitable examples and labelled diagram. [5]
 c) Explain any four applications of UV-Visible spectroscopy. [4]

OR

- Q7)** a) i) State and give mathematical expression of Beers and Lambert's law of absorption. [4]
 ii) Define- [2]
 1) Auxochrome
 2) Hypsochromic shift
 b) What are the conditions of IR radiations by the molecule? Explain the fundamental modes of streching vibrations. [5]
 c) Give the principle of IR spectroscopy. Calculate the fundamental modes of vibrations for the following molecules. [4]
 i) NO
 ii) H_2O
 iii) C_2H_6

- Q8)** a) State Pilling Bedworth ratio and give its significance. Give the different types of oxide films with suitable example formed during the oxidation corrosion of metals. [6]
- b) What is principle of cathodic protection? Explain the method involved using sacrificial anode and give its two applications. [5]
- c) What are anodic and cathodic coatings? Which one is more protective and why? [4]

OR

- Q9)** a) Explain the mechanism of wet corrosion by hydrogen evolution and oxygen absorption with diagram and reactions. [6]
- b) Explain any five factors affecting the rate of corrosion related to metal. [5]
- c) Define electroplating. Give the electroplating reactions with respect to the metals like Ag, Ni and Cr. [4]

