

Total No. of Questions : 4]

SEAT No. :

[Total No. of Pages : 2

P3

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 = 0.1 m^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 : 9]

SEAT No. :

P-3920

[Total No. of Pages : 4

[6001]-4003

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 Q.2 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 tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data, if necessary.*

Q1) Multiple Choice Questions :

- i) Electroluminescent polymers are used in : [1]
 - a) Solar cell technology
 - b) Digital display
 - c) LED
 - d) All of above
- ii) Properties of polymer composite depends on : [1]
 - a) colour of particle
 - b) monomer
 - c) size of particle
 - d) none of the above
- iii) Which of following industries have prominent applications for quantum dots? [1]
 - a) Electronic
 - b) Agriculture
 - c) Medical
 - d) None
- iv) In _____ λ_{\max} shift to higher side. [1]
 - a) hyperchromic effect
 - b) hypochromic effect
 - c) bathochromic shift
 - d) blue shift

P.T.O.

- v) Following is the most important characteristic of a good fuel. [1]
 a) high heat value b) bright light
 c) high sound d) colourful smoke
- vi) Following is not a prominent application of UV spectroscopy. [1]
 a) Study of reaction kinetics
 b) Detection of functional group
 c) Quantitative analysis
 d) Qualitative analysis
- vii) The possible number of fundamental modes of vibrations in case of CO₂ molecule is [1]
 a) 2 b) 3
 c) 4 d) 5
- viii) In the process of tinning : [1]
 a) Zn is coated on Fe
 b) Sn is coated on Fe
 c) Sn is coated on Zn
 d) Fe is coated on Zn
- ix) Ideal pilling Bed worth ratio for effective protection of metal against corrosion is [1]
 a) $PBR < 1$
 b) $PBR \geq 1$
 c) $PBR > 2$
 d) $PBR > 2.5$
- x) Sacrificial anode is [1]
 a) anodic protection method
 b) cathodic protection method
 c) an example of metal cladding
 d) an example of powder coating
- Q2)** a) What are conductive polymer? Give types of conducting polymers. Explain doping with reactions and give any two applications of conducting polymers. [6]
- b) Give classification and any four applications of SWCNT. [5]
- c) Give structure, any three properties and any three applications of polycarbonate. [4]

OR

- Q3)** a) Explain with diagram the structure of graphene. Give three properties and three applications of it. [6]
- b) What is biodegradable polymer? Give three factors affecting biodegradation process of a polymer. Give any two applications of biodegradable polymer. [5]
- c) What are quantum dots? Give any two types of quantum dots. Write any two applications of Q.D.S. [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) Explain fractional distillation process with diagram for petroleum crude. Give composition, boiling temperature range and use of any one fraction. [5]
- c) Exactly 2.500 gram was weighed into silica crucible. After heating for one hour at 110°C the residue weighed 2.415 gram. The crucible next was covered with vented lid and strongly heated for exactly seven minutes at $950 \pm 20^\circ\text{C}$. The residue weighed 1.528 gram. The crucible was then heated without the cover, until a constant weight was obtained. The last residue was found to weight 0.245 gram. Calculate % moisture, % volatile matter, % ash and % Fixed carbon. [4]

OR

- Q5)** a) Give construction with figure and working of Bomb calorimeter. Write corrected formula to find out Gross calorific value of a coal using Bomb calorimeter. [6]
- b) What is 'Power Alcohol'? Give procedure for preparation of ethanol with reactions. Give any two advantages of Power alcohol. [5]
- c) Observations in the Boy's Gas calorimeter experiments are given below; find GCV and NCV of fuel. [4]

Volume of gas burnt at STP = 0.08m³

Mass of cooling water used = 29.5 kg

Rise in temperature of circulating water = 9.1°C

Mass of steam condensed = 0.04 kg

- Q6)** a) Explain with diagram the possible electronic transitions those may occur in organic molecule on absorption of UV-radiations. Also state forbidden electronic transitions. [6]
- b) Explain conditions for IR radiation absorption by organic molecule. Describe any three applications of IR spectroscopy. [5]
- c) Give statement and mathematical expression of Lambert-Beer's Law. [4]

OR

- Q7)** a) With the help of diagram explain construction of IR spectrometer. Describe different components of IR spectrometer. [6]
- b) Give any five applications of UV-visible spectroscopy. [5]
- c) Explain bending vibrations observed in IR spectroscopy. [4]
- Q8)** a) Explain hydrogen evolution and oxygen absorption mechanisms of wet corrosion with diagram and reactions. [6]
- b) Explain any five factors responsible for corrosion of metals. [5]
- c) What is galvanisation? Explain process with diagram. [4]

OR

- Q9)** a) Explain types of oxide films with corrosion reactions for metals, Na, Al, Ag, Mo. [6]
- b) Explain process of electroplating with the help of neat labeled diagram. Give any four applications of electroplating. [5]
- c) Distinguish between anodic and cathodic coatings. [4]



Total No. of Questions—8]

[Total No. of Printed Pages—4

Seat No.	
-------------	--

[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]

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 MgCl_2 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]

SEAT No. :

P1270

[Total No. of Pages : 2

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. :

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]

