| Name: <br> Enrolment No: |  |  |  |
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| Course: Chemistry <br> Program: B. Tech. (EE, ECE, APE-UP, ASE, ASE-Avionics) <br> Course Code: CHEM 1011 | $\left.\begin{array}{lrl} & \text { UNIVERSITY OF PETROLEUM AND ENERGY STUDIES } \\ \text { Online End Semester Examination, June 2021 }\end{array}\right]$ Semester: 1 |  |  |
| 1. Each question will carry 5 marks2. Instruction: Complete the statement/ Select the correct answer |  |  |  |
| S. No. | Question | Marks | CO |
| Q 1 | (i) The octane number of a fuel containing $80 \%$ of n-heptane and $20 \%$ of $2,2,4$ trimethylpentane will be ... <br> (ii) Unburned material remaining after $750^{\circ} \mathrm{C}$ during the proximate analysis of coal is known as... <br> (iii) Among cyclopropane, cyclobutane, cyclopentane, cyclohexane and cycloheptane which two are more stable? <br> (iv) Write any two characteristic points of an aromatic compounds. <br> (v) Out of $\mathrm{NO}_{2}^{-}, \mathrm{NO}_{2}^{+}, \mathrm{HNO}_{3}$ and $\mathrm{NO}_{3}$, which one is the reactive species for the nitration of benzene? | 5 | CO1 |
| Q 2 | (i) Before the establishment of Lindemann theory, it was difficult to justify the mechanism of $\ldots$ order of reaction. (First/Second/Third/All) <br> (ii) The concentration of a reactant of a reaction was measured by UV-Vis technique, at two time intervals with proceeding of the reaction. At the first time interval, the concentration of the reactant is $0.45 \mathrm{~mol} \mathrm{~L}^{-1} ; 240$ seconds later, the concentration is $0.25 \mathrm{~mol} \mathrm{~L}^{-1}$. What is the rate the reaction in $\mathrm{mol} \mathrm{L}^{-1} \mathrm{~min}^{-1}$ ? <br> (iii) The half-life period for a first order reaction is 15 minutes; calculate the time taken in minute, for completion of 75,80 and $90 \%$ completion of the reaction. | $(1+1+3)$ | CO2 |
| Q 3 | (i) Write the name of any two methods by which the order of reaction can be determined. <br> (ii) The following concentrations (in moles/liter) were obtained for the formation of $\mathrm{NH}_{3}$ from $\mathrm{N}_{2}$ and $\mathrm{H}_{2}$ at equilibrium at $500 \mathrm{~K} .\left[\mathrm{N}_{2}\right]=0.015,\left[\mathrm{H}_{2}\right]=0.03$ and $\left[\mathrm{NH}_{3}\right]=0.012$. The equilibrium constant of the reaction will be... <br> (iii) What will be the value of $\mathrm{K}_{\mathrm{c}}$ if the $\mathrm{K}_{\mathrm{p}}$ is 0.61 for a reaction, $\mathrm{PCl}_{5} \rightleftharpoons \mathrm{PCl}_{3}+\mathrm{Cl}_{2}$ at $25^{\circ} \mathrm{C}$ ? | $(1+2+2)$ | CO2 |


| Q 4 | (i) On increasing dilution, the equivalent conductance of the solution will ... <br> (ii) We can store a one molar $\mathrm{CuSO}_{4}$ solution in Zn container. (True/False) <br> (iii) We can store a two normal $\mathrm{ZnSO}_{4}$ solution in Cu container. (True/False) <br> (iv) Kohlrausch law is not applicable for calculation of conductivity of weak electrolyte.(True/False) <br> (v) The equivalent conductance of $\mathrm{Ca}^{2+}$ and $\mathrm{Cl}^{-}$are 77 and $76 \mathrm{Ohm}^{-1} \mathrm{~cm}^{-1} \mathrm{eq}^{-1}$ at infinite dilution, respectively. The equivalent conductance of $\mathrm{CaCl}_{2}$ at infinite dilution will be. $\qquad$ $\mathrm{Ohm}^{-1} \mathrm{~cm}^{-1} \mathrm{eq}^{-1}$. | 5 | CO 3 |
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| Q 5 | (i) Two important advantages of hard water are .... and ....... <br> (ii) Permanent hardness of water is due to ... and ............. <br> (iii) Temporary hardness of water may be due the presence of ....... and ........ salts. <br> (iv) Zeolite process uses the ......salt for its regeneration. <br> (v) Fluoride ion is removed by R.O; using ......ion exchange resin. (Cation/Anion) | 5 | CO4 |
| Q 6 | (i) Urea-formaldehyde resin is a thermosetting plastic. (True/False) <br> (ii) Nylon is a type of polyamide. (True/False) <br> (iii) Paints are synthesized using bulk polymerization. (True/False) <br> (iv) Weight average molecular weight is always lower than number average molecular weight, of polymers. (True/False) <br> (v) Write the name of any two methods for preparation of nano particles. | 5 | CO5 |
|  |  SECTION B <br> Each question will carry 10 marks  <br> Instruction: Write short / brief notes  |  |  |
| Q 1 | (i) Derive the rate constant equation for a second order reaction (2 A $\rightarrow$ Product). <br> (ii) Derive the rate expression for given below type of isomerisation reaction in the chemical refinery. <br> Where $K_{1} \& K_{2}$ are the rate constant for forward and backward reaction respectively. | (4+6) | CO2 |
| Q 2 | The emf of cell- $\begin{gathered} \mathrm{Ni}(\mathrm{~s}) / \mathrm{Ni}^{2+}(\mathrm{a}) / / \mathrm{Cu}^{2+}(0.75 \mathrm{M}) / \mathrm{Cu}(\mathrm{~s}) ; \text { is } 0.601 \mathrm{~V} \text { at } 25^{0} \mathrm{C} . \\ \mathbf{E}^{\mathbf{0}}\left(\mathrm{Ni}_{\mathrm{Ni}}{ }^{\mathbf{2 +}}\right)=+\mathbf{0 . 2 5} \mathbf{~ V}, \mathbf{E}^{\mathbf{0}}\left(\mathrm{Cu}^{2+} / \mathrm{Cu}\right)=+\mathbf{0 . 3 4} \mathbf{~ V} . \end{gathered}$ <br> (i) Write down the half-cell reaction \& complete cell reaction. <br> (ii) Find out the concentration of $\mathrm{Ni}^{2+}$ i.e. the value of "a". <br> (iii) Does temperature have any effect on the value of $\mathrm{E}_{\text {cell }}$ ? Describe the same in two lines, what happen on the value of $\mathrm{E}_{\text {cell }}$ of above reaction if it will increase or decrease. | $(4+4+2)$ | CO 3 |


| Q 3 | (i) Discuss the effect of dilution on the conductance of strong and weak electrolyte using appropriate illustrations. <br> (ii) Describe alongwith a neat sketch that how corrosion be controlled by sacrificial anodic protection method? | 10 | CO 3 |
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| Q 4 | (i) 25 ml of a sample of water required 15 ml of $\mathrm{N} / 50 \mathrm{H}_{2} \mathrm{SO}_{4}$ using methyl orange indicator but did not give any coloration with phenolphthalein. Determine the type and extent of alkalinity is present. <br> (ii) A sample of water on analysis was found to contain following impurities: $\begin{array}{llll} \mathrm{Ca}\left(\mathrm{HCO}_{3}\right)_{2} & : 4 \mathrm{mg} / \mathrm{lt} & \mathrm{Mg}\left(\mathrm{HCO}_{3}\right)_{2}: 6 \mathrm{mg} / \mathrm{lt} \\ \mathrm{CaSO}_{4} & : 8 \mathrm{mg} / \mathrm{lt} & \mathrm{MgSO}_{4} & : 10 \mathrm{mg} / \mathrm{lt} \end{array}$ <br> Calculate temporary, permanent and total hardness in ppm. Given that atomic weights of $\mathrm{Mg}=24 ; \mathrm{Ca}=40 ; \mathrm{S}=32 ; \mathrm{O}=16$ and $\mathrm{C}=12$. | 10 | CO4 |
| Q 5 | (i) X rays of wavelength 0.1537 nm from a Cu target are diffracted from the (111) planes of an FCC metal. Calculate the distance between adjacent Miller planes for a first order reflection. Bragg's angle is $19.2^{\circ}$. <br> (ii) Differentiate between thermoplastics and thermosetting polymers. | 10 | $\mathrm{CO5}$ |
|  | SECTION-C <br> Each question carries 20 marks <br> Instruction: Write long answers |  |  |
| Q 1 | (i) A sample of coal contains $\mathrm{C}=92.2 \%, \mathrm{H}=6.3 \%$ and ash $=1.5 \%$. The following data were obtained when the above coal was tested in a bomb calorimeter: <br> Weight of coal burnt <br> Weight of water taken $\begin{aligned} & =0.93 \mathrm{~g} \\ & =560 \mathrm{~g} \end{aligned}$ <br> Water equivalent of bomb and calorimeter $=2,210 \mathrm{~g}$ <br> Rise in temperature $=2.32^{\circ} \mathrm{C}$ <br> Fuse wire correction $=11.0 \mathrm{cal}$ <br> Acid correction $=53.0 \mathrm{cal}$ <br> Calculate the gross and net calorific value of coal, assuming that the latent heat of condensation of steam is $583 \mathrm{cal} / \mathrm{g}$. <br> OR <br> Estimate the value of enthalpy of combustion for ethane and butane. Using the bond energies data as given below in $\mathbf{k J} / \mathbf{m o l e}$ for different bonds. | $\begin{gathered} 10 \\ + \\ 10 \end{gathered}$ | CO1 |


| (ii) Describe the need of ultimate analysis in chemistry in short. During estimation of |
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| nitrogen present in organic compound by Kjeldahl's method, 3.12 g of an organic |
| substance was heated with conc. sulphuric acid and then distilled with excess of |
| strong alkali. The ammonia gas evolved was absorbed in 50 ml of $\mathrm{N} / 10 \mathrm{HCl}$. After |
| absorption, the excess acid requires 12.5 ml of 0.1 N NaOH for neutralization. |
| Determine the percentage of nitrogen in the substance. |
| OR |$\quad$| Write down the limitation of the proximate analysis in a paragraph. An organic |
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| compound (0.2346 g) containing carbon, hydrogen and oxygen only, was analyzed |
| by the combustion method. The increase in weight of the U-tube and the potash |
| bulbs at the end of the operation was found to be 0.2754 g and 0.4488 g |
| respectively. Calculate the percentage of carbon, hydrogen and oxygen in it. |$\quad$.

