File No. :

K.S. GROUP OF INSTITUTIONS

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT

#15, Mallasandra, Near Vajarahalli, Off. Kanakapura Road, Bengaluru - 560 109

Ph. : +91 80 28425163 / +91 88844 44408, website : www.kssem.edu.in

COURSE FILE: 2023-2024

Even Semester

Dr. ANITHA. R

Assistant Professor

Department of Applied Science

K S School of Engineering and Management, Bangalore-560109

CSE-A (EVEN SEM)

K S SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU-560109

DEPARTMENT OF APPLIED SCIENCE

COURSE FILE

BCHES202- CHEMISTRY FOR CSE STREAM

II SEM-2023-2024

FACULTY IN CHARGE

Dr. ANITHA. R

Assistant professor

Department of Applied Science

K S SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE-560109

DEPARTMENT OF APPLIED SCIENCE AND HUMANITIES

CONTENTS

K S SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE-560109

DEPARTMENT OF APPLIED SCIENCE AND HUAMNITIES

VISION

To impart quality education in engineering and management to meet technological, business and societal needs through holistic education and research.

MISSION

K.S. School of Engineering and Management shall,

- Establish state-of-art infrastructure to facilitate effective dissemination of technical and managerial knowledge.
- Provide comprehensive educational experience through a combination of curricular and experimental learning, strengthened by industry-institute interaction.
- Pursue social relevant and disseminate knowledge.
- Inculcate leadership skills and foster entrepreneurial spirit among students.

DEPARTMENT OF APPLIED SCIENCE AND HUMANITIES

VISION

To lay sound foundation in Applied Science and prepare the students to learn engineering better.

MISSION

Department of Applied Science shall,

- Acquire abilities to evaluate problems using Mathematics.
- Provide a platform to keep abreast with current development in science.
- Imbibe communication skills and inculcate human values.

16-2-2023

Computer Science and Engineering and allied branches(Chemistry group)

Course Title:	Applied Chemistry for Computer Science &Engineering stream		
Course Code:	BCHES102/202	CIE Marks	50
Course Type(Theory/Practical/Integrated)	Integrated	SEE Marks	50
		Total Marks	100
TeachingHours/Week(L:T:P:S)[1]	2:2:2:0	Exam Hours	03
TotalHoursofPedagogy	40hoursTheory+ 10to12Labslots	Credits	04

Courseobjectives

- Toenablestudentstoacquireknowledgeonprinciplesofchemistryforengineeringapplications.
- Todevelopanintuitiveunderstandingofchemistrybyemphasizingtherelatedbranchesofengineering.
- Toprovidestudentswithasolidfoundationinanalyticalreasoningrequiredtosolvesocietalproblems.

Teaching-LearningProcess

Thesearesamplestrategies,whichteachercanusetoacceleratetheattainmentofthevariouscourseoutcomesandmakeTeaching–Learningmoreeffective

- Tutorial&remedialclassesforneedystudents(notregularT/R)
- ConductingMakeupclasses/Bridgecourses forneedystudents
- Demonstrationofconceptseitherbybuildingmodelsorbyindustryvisit
- Experimentsinlaboratoriesshallbeexecutedinblendedmode(conventionalornon–conventionalmethods)
- UseofICT–Onlinevideos,onlinecourses
- Useofonlineplatformsforassignments/Notes/Quizzes(Ex.Googleclassroom)

MODULE1:SensorsandEnergySystems(8hr)

Sensors:Introduction,working,principleandapplicationsofConductometricsensors,Electrochemical sensors,Thermometricsensors (Flame photometry)andOpticalsensors (colorimetry).Sensorsforthemeasurement of dissolved oxygen (DO). Electrochemical sensors for the pharmaceuticals.ElectrochemicalgassensorsforSO_xandNO_x.Disposablesensorsin thedetectionofbiomoleculesandpesticides.

EnergySystems:Introductiontobatteries,construction,workingandapplicationsofLithiumionandSodiumionbatteries.QuantumDotSensitizedSolarCells(QDSSC's)-Principle, PropertiesandApplications.

Self-learning: Types of electrochemical sensor, Gas sensor - O_2 sensor, Biosensor - Glucosesensors.

MODULE2:MaterialsforMemoryandDisplaySystems(8hr)

Memory Devices: Introduction, Basic concepts of electronic memory, History of organic/polymerelectronicmemorydevices,Classificationofelectronicmemorydevices,

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1.NOTE:Whereverthecontact hoursisnotsufficient,tutorialhourcanbeconvertedto theoryhours

typesoforganicmemorydevices(organicmolecules,polymericmaterials,organic-inorganichybridmaterials).

DisplaySystems: Photoactiveandelectroactivematerials,Nanomaterialsandorganicmaterials used in optoelectronic devices. Liquid crystals (LC's) - Introduction, classification,properties and application in Liquid Crystal Displays (LCD's). Properties and application ofOrganic Light Emitting Diodes (OLED's) and Quantum Light Emitting Diodes (QLED's), Lightemittingelectrochemicalcells.

Self-learning: PropertiesandfunctionsofSilicon(Si),Germanium(Ge),Copper(Cu), Aluminium(Al),andBrominatedflameretardantsincomputers.

MODULE3:CorrosionandElectrodeSystem(8hr)

CorrosionChemistry: Introduction,electrochemicaltheoryofcorrosion,typesofcorrosion-differentialmetalanddifferentialaeration.Corrosioncontrol-galvanization,anodization and sacrificial anode method. Corrosion Penetration Rate (CPR) - Introductionandnumerical problem.

Electrode System: Introduction, types of electrodes. Ion selective electrode – definition,construction, working and applications of glass electrode. Determination of pH using glasselectrode. Reference electrode- Introduction, calomel electrode– construction, workingandapplicationsofcalomelelectrode.Concentrationcell– Definition,constructionandNumericalproblems.

Analytical Techniques: Introduction, principle and instrumentation of Conductometry; itsapplication in the estimation of weak acid. Potentiometry; its application in the estimationofiron.

Seif-learning:IRandUV-Visiblespectroscopy.

MODULE4:PolymersandGreenFuels(8hr)

Polymers: Introduction,Molecularweight-Numberaverage,weightaverageandnumericalproblems.Preparation,properties,andcommercialapplicationsofkevlar. Conductingpolymers–synthesisandconductingmechanismofpolyacetyleneandcommercialapplications.

Green Fuels: Introduction, construction and working of solar photovoltaic cell, advantages and disadvantages. Generation of energy (green hydrogen) by electrolysis of water and itsadvantages.

Self-learning: Regenerativefuelcells

MODULE5:E-WasteManagement(8hr)

E-Waste: Introduction, sources of e-waste, Composition, Characteristics, and Need of e-wastemanagement.Toxicmaterialsusedinmanufacturingelectronicandelectricalproducts, health hazards due to exposure to e-waste. Recycling and Recovery: Differentapproachesofrecycling(separation,thermaltreatments,hydrometallurgicalextraction,pyro metallurgical methods, direct recycling). Extraction of gold from E-waste. Role of stakeholders in environmental management of e-waste (producers, consumers, recyclers, andstatutorybodies).

Self-learning: Impactofheavymetalsonenvironmentandhumanhealth.

PRACTICALMODULE

A–Demonstration(anytwo)offline/virtual:

A1.ChemicalStructure drawingusingsoftware:ChemDraworACD/ChemSketch

A2. Determination of strength of an acid in Pb-acid batteryA3:SynthesisofIron-oxideNanoparticles
A4.Electrolysisofwater

B–Exercise(compulsorilyany4tobeconducted):

B1.Conductometricestimationofacidmixture
B2.PotentiometricestimationofFASusing$K_2Cr_2O_7$
B3.DeterminationofpKaofvinegarusingpHsensor(Glasselectrode)
B4.Determinationofrateofcorrosionofmildsteelbyweightlossmethod B5. Estimationoftotalhardnessofwaterby EDTA method

C–StructuredEnquiry (compulsorilyany4tobeconducted):

C1. Estimation of Copper present in electroplating effluent by optical sensor (colorimetry) C2. Determination of Viscosity coefficient of lubricant (Ostwald's viscometer)
C3. Estimation of iron in TMT bar by diphenyl amine/external indicator method C4. Estimation of Sodium present in soil/effluent sample using flame photometry
C5. Determination of Chemical Oxygen Demand (COD) of industrial wastewater sample

D–OpenEndedExperiments(anytwo):

D1:Evaluationofacidcontentinbeveragesbyusing pH sensors and simulation. D2. Construction of photovoltaic cell.
D3. Design an experiment to identify the presence of protein in given sample.
D4. Searching suitable PDB file and target for molecular docking

Courseoutcome(CourseSkillSet)

At the end of the course the student will be able to:

CO1.	Identify the terms processes involved in scientific and engineering andapplications
CO2.	Explain the phenomena of chemistry to describe the methods of engineering processes
CO3.	Solve the problems in chemistry that are pertinent in engineering applications
CO4.	Apply the basic conceptsofchemistry to explain the chemical properties and processes
CO5.	Analyze properties and multidi processes associated with chemical substances in sciplinary situations

AssessmentDetails(bothCIEandSEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

ContinuousInternalEvaluation(CIE):

The CIE marks for the theory component of the IC shall be **30 marks** and for the laboratory component **20 Marks**.

CIE for the theory component of the IC

- Three Tests each of 20 Marks; after the completion of the syllabus of 35-40%, 65-70%, and 90-100% respectively.
- Two Assignments/two quizzes/ seminars/one field survey and report presentation/one-course project totalling 20 marks.

Total Marks scored (test + assignments) out of 80 shall be scaled down to **30 marks**

CIE for the practical component of the IC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The **15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to **05 marks.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IC/IPCC for **20 marks.**

- The minimum marks to be secured in CIE to appear for SEE shall be 12 (40% of maximum marks) in the theory component and 08 (40% of maximum marks) in the practical component. The laboratory component of the IC/IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included. The maximum of 05 questions is to be set from the practical component of IC/IPCC, the total marks of all questions should not be more than 25 marks.

The theory component of the IC shall be for both CIE and SEE.

Semester End Examination(SEE):

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject **(duration 03 hours)**

- The question paper shall be set for 100 marks. The medium of the question paper shall be English/Kannada). The duration of SEE is 03 hours.
- The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks. The students have to answer 5 full questions, selecting one full question from each module. The student has to answer for 100 marks and **marks scored out of 100 shall be proportionally reduced to 50 marks.**

There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

SuggestedLearningResources:

Books(TitleoftheBook/Nameoftheauthor/Nameofthepublisher/EditionandYear)

1. WileyEngineeringChemistry,WileyIndiaPvt.Ltd.NewDelhi,2013-2nd Edition.
2. EngineeringChemistry,Satyaprakash&ManishaAgrawal,KhannaBookPublishing,Delhi
3. ATextBookofEngg.Chemistry,ShashiChawla,DhanpatRai&Co.(P)Ltd.
4. EssentialsofPhysicalChemistry,Bahl&Tuli,S.ChandPublishing
5. AppliedChemistry,SunitaRattan,Kataria5.EngineeringChemistry,Baskar,Wiley
6. EngineeringChemistry–I,D.GrourKrishana,VikasPublishing
7. ATextbookofEngineeringChemistry,SSDara&Dr.SSUmare,SChand&CompanyLtd.,12thEdition,2011.
8. ATextBookofEngineeringChemistry,R.V.GadagandNityanandaShetty,I.K.InternationalPublishinghouse. 2nd Edition,2016.
9. TextBookofPolymerScience,F.W.Billmeyer,JohnWiley&Sons,4thEdition,1999.
10. NanotechnologyAChemicalApproachtoNanomaterials,G.A.Ozin&A.C.Arsenault,RSCPublishing,2005.
11. CorrosionEngineering,M.G.Fontana,N.D.Greene,McGrawHillPublications,NewYork,3rdEdition,1996.

12. Linden'sHandbookofBatteries,KirbyW.Beard,FifthEdition,McGrawHill,2019.
13. OLEDDisplayFundamentalsandApplications,TakatoshiTsujimura,Wiley–Blackwell,2012
14. Supercapacitors:Materials,Systems,andApplications,MaxLu,FrancoisBeguin,ElzbietaFrackowiak,Wiley-VCH;1stedition,2013.
15. "HandbookonElectroplatingwithManufactureofElectrochemicals",ASIAPACIFICBUSINESSPRESS Inc., 2017. Dr.H. Panda,
16. ExpandingtheVisionofSensorMaterials.NationalResearchCouncil1995.Washington,DC:TheNationalAcademies Press. doi:10.17226/4782.
17. EngineeringChemistry,EditedbyDr.MaheshBandDr.RoopashreeB,SunstarPublisher,Bengaluru,ISBN978-93-85155-70-3, 2022
18. HighPerformanceMetallicMaterialsforCostSensitiveApplications,F.H.Froes,etal.JohnWiley&Sons, 2010
19. InstrumentalMethodsofAnalysis,Dr.K.R.MahadikandDr.L.Sathiyanarayanan,NiraliPrakashan,2020
20. PrinciplesofInstrumentalAnalysis,DouglasA.Skoog,F.JamesHoller,StanleyR.CrouchSeventhEdition,Cengage Learning, 2020
21. PolymerScience,VRGowariker,NVViswanathan,Jayadev,Sreedhar,NewageInt.Publishers,4thEdition, 2021
22. EngineeringChemistry,PCJain&MonicaJain,DhanpatRaiPublication,2015-16thEdition.
23. Nanostructuredmaterialsandnanotechnology,Hari Singh, Nalwa,academicpress, 1stEdition,2002.
24. NanotechnologyPrinciplesandPractices,SulabhaKKulkarni,CapitalPublishingCompany,3rdEdition2014
25. Principlesofnanotechnology,Phanikumar,Scitechpublications,2ndEdition,2010.
26. ChemistryforEngineeringStudents,B.S.JaiPrakash,R.Venugopal,Sivakumaraiah&PushpaIyengar.,SubashPublications,5thEdition, 2014
27. "EngineeringChemistry",O.G.Palanna,TataMcGrawHillEducationPvt.Ltd.NewDelhi,FourthReprint,2015.
28. ChemistryofEngineeringmaterials,MaliniS,KSAnanthaRaju,CBSpublishersPvtLtd.,
29. LaboratoryManualEngg.Chemistry,AnupmaRajput,DhanpatRai&Co.

WeblinksandVideoLectures(e-Resources):

- http://libgen.rs/
- https://nptel.ac.in/downloads/122101001/
- https://nptel.ac.in/courses/104/103/104103019/
- https://ndl.iitkgp.ac.in/
- https://www.youtube.com/watch?v=faESCxAWR9k
- https://www.youtube.com/watch?v=TBqXMWaxZYM&list=PLyhmwFtznRhuz8L1bb3X-9JbHrDMjHWWh
- https://www.youtube.com/watch?v=j5Hml6KN4TI
- https://www.youtube.com/watch?v=X9GHBdyYcyo
- https://www.youtube.com/watch?v=1xWBPZnEJk8
- https://www.youtube.com/watch?v=wRAo-M8xBHM

Visvesvaraya Technological University, Belagavi.

A blow-up of the syllabus for Chemistry for

Computer Science and Engineering and allied branches (CSE/ISE and BT)
(Chemistry group)

MODULE 1: Sensors and Energy Systems (8hr)		
Sl No	Details	Duration
1.	Sensors: Introduction - Definition and terminologies of Transducer Actuators and Sensors. Working principle and any four applications of Electrochemical sensors,	1 hr
2.	Working principle and any four applications of Conductometric sensors (conductometry), and Optical sensors (colorimetry),	1 hr
3.	Electrochemical Sensor for the measurement of Dissolved Oxygen (DO); With brief introduction to different sensors, explain the principle, experimental procedure with electrode reactions.	1 hr
4.	Electrochemical Sensor for pharmaceuticals; example-Diclofenac, and hydrocarbons; example-1-hydroxypyrene (explain with electrochemical oxidation reactions)	1 hr
5.	Electrochemical gas sensors for SOx and NOx; Working principle with electrode reactions	1 hr
6.	Disposable sensors (DS); Definition, advantages of DS over Classical sensors. Detection of biomolecules; Example-Ascorbic acid (AA) explain with Oxidation of AA to Dehydroascorbic acid, Pesticides; example-Glyphosate (explain with electrochemical oxidation)	1 hr
7.	Energy Systems: Introduction to batteries, construction, working and applications of Lithium-ion and Sodium-ion batteries	1 hr
8.	Quantum Dot Sensitized Solar Cells (QDSSC's)- Principle, Properties and Applications (any four).	1 hr
MODULE 2: Materials for Memory and Display Systems (8hr)		
1.	Memory Devices: Introduction, Basic concepts of electronic memory, History of organic/polymer electronic memory devices,	1 hr
2.	Classification of electronic memory devices (Transistor-Type, Capacitor-Type, Resistor-Type and Charge transfer type Electronic Memory devices),	1 hr
3.	types of organic memory devices; Organic molecules (p-type semiconductor – ex., Pentacene; n-type ex., Perfluoropentacene used as memory materials)	1hr
4.	types of organic memory devices; polymeric material (Polyimide as an example with Donor-Triphenylamine; Acceptor–phthalimide)	1hr
5.	Display Systems: Photoactive and electroactive materials - Definition and principle for photoactive and electroactive. Optoelectronic devices: Definition, working principle.	1hr

6.	Nanomaterials (Silicon Nanocrystals) and organic materials [Light absorbing materials - Polythiophenes (P3HT), Light emitting materials - Poly[9-vinylcarbazole] (PVK)] Explain any four properties why they are used in optoelectronic devices.	1hr
7.	Liquid crystals (LC's) - Introduction, classification properties and application in Liquid Crystal Displays (LCD's)	1hr
8.	Organic Light Emitting Diodes (OLED's) and Quantum Light Emitting Diodes (QLED's) – Mention any four Properties and applications.	1hr
	MODULE 3: Corrosion and Electrode System (8hr)	
1.	Corrosion Chemistry: Introduction (ill effects, global losses), electrochemical theory of corrosion (principle, reactions under different conditions and diagram taking iron as an example)	1hr
2.	Types of corrosion: Differential metal - Definition, Principle, Process and application), Differential aeration – (Water line) – principle and explanation,	1hr
3.	Corrosion control – Introduction (Definition, Principle and application) galvanization, Anodization and sacrificial anode method (explain with neat diagrams and reactions wherever applicable)	1hr
4.	Corrosion Penetration Rate (CPR)- Introduction - (Definition, formula and importance), Numerical problems	1hr
5.	Electrode System: Introduction, types of electrodes; Ion selective electrode – definition, construction, working and applications of the glass electrode.	1hr
6.	Determination of pH using glass electrode, Reference electrode: Introduction - (Definition and role of reference electrode); Calomel electrode – Construction, working and applications of calomel electrode	1hr
7.	Concentration cell – Definition, construction, working and Numerical problems.	1hr
8.	Analytical Techniques: Introduction, principle, and instrumentation of Conductometry; its application in the estimation of a weak acid. Potentiometry; its application in the estimation of iron.	1hr
	MODULE 4: Polymers and Green Fuels (8hr)	
1.	Polymers: Introduction, Molecular weight - Number average, weight average and numerical problems.	1hr
2.	Conducting polymers – Synthesis and conducting mechanism of polyacetylene and commercial applications	1hr
3.	Preparation, properties, and commercial applications of graphene oxide.	1hr
4.	Green Fuels: Introduction to different types of fuels, past and future perspective of green fuels.	1hr
5.	construction and working of solar photovoltaic cell, advantages, and disadvantages	1hr
6.	Green hydrogen: Introduction to properties of hydrogen pertaining to fuel. Introduction to electrolysis of water.	1hr
7.	Generation of hydrogen by electrolysis of water: Alkaline water electrolysis (Explain the electrolysis of water with diagram and electrode reactions) and mention any 4 advantages	1hr

8.	Electrolysis of water – Proton Exchange Membrane Electrolysis (Explain the electrolysis of water with diagram and electrode reactions) and mention any 4 advantages	1hr
	MODULE 5: E-Waste Management (8hr)	
1.	E-Waste: Introduction, sources of e-waste, Composition and Characteristics,	1hr
2.	Need for e-waste management concerning global perspective	1hr
3.	Toxic materials used in manufacturing electronic and electrical products; health hazards due to exposure to e-waste.	1hr
4.	Recycling and Recovery: Different approaches of recycling (separation, thermal treatments),	1hr
5.	hydrometallurgical extraction, pyrometallurgical methods and direct recycling.	1hr
6.	Extraction of gold from e-waste (Explain the Principle and experimental procedure)	1hr
7.	Role of stakeholders in the environmental management of e-waste: Who are called stakeholders – a local and global perspective	1hr
8.	Role of stakeholders - producers, consumers, recyclers, and statutory bodies.	1hr

K. S. SCHOOL OF ENGINEERING AND MANAGEMENT
BENGALURU-560109
CALENDAR OF EVENTS: II EVEN SEMESTER (2023-2024)
SESSION: MAR TO JUNE 2024

Week No.	Month	Day						Days	Activities
		Mon	Tue	Wed	Thu	Fri	Sat		
1	MAR			6*	7	8 II	9 TA	3	6*-Commencement of II sem 8- Maha Shivratri 9- Tuesday Time Table
2	MAR	11	12	13	14	15	16 DH	5	
3	MAR	18	19	20	21	22	23	6	23 - Friday Time Table
4	MAR	25	26	27	28	29 II	30	5	29- Good Friday 30 - Monday Time Table
5	APR	1	2	3	4	5 TA	6 DH	5	
6	APR	8	9 II	10	11 II	12	13ASD	4	9 - Ugadi 11 - Kutub A Ramzan 13-Tuesday Time Table
	APR	15	16	17	18	19	20 DH	5	
8	APR	22T1	23T1	24T1	25* FFBI	26	27	6	27- Wednesday Time Table T1- 22,23 & 24- 1st Internal test
9	APR/MAY	29	30	1 II	2	3	4 DH	4	1- May Day
10	MAY	6	7	8	9	10 H	11	5	10 - Basava Jayanthi 11- Friday Time Table
11	MAY	13	14	15	16	17ASD	18DH	5	
12	MAY	20	21	22	23	24	25	6	25-Monday Time Table
13	MAY/ JUNE	27BV	28	29T2	30T2	31*FFB-II	1DH	5	T2- 29,30-2nd Internal test
14	JUNE	3T2	4	5	6	7	8	6	T2-03-2nd Internal test 8-Monday Time Table
15	JUNE	10	11	12	13	14	15DH	5	
16	JUNE	17II	18	19	20	21	22	5	17-Bakrid
17	JUNE	24	25	26	27T3	28T2	29T3*	6	T3-27 to 29 3rd Internal test 29* last working
18	JULY	1LT	2LT	3LT	4LT			4	

Total Number of working days (Excluding holidays and Tests)=77

H	Holiday
BV	Blue Book Verification
T1,T2,T3	Tests 1,2,3
ASD	Attendance & Sessional Display
DH	Declared Holiday
LT	Lab Test
TA	Test attendance

Monday	16
Tuesday	16
Wednesday	17
Thursday	17
Friday	14
Saturday	10
Total	90

Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Management
Bengaluru - 560 109

Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management
Bangalore - 560 109

K. S. SCHOOL OF ENGINEERING AND MANAGEMENT
BENGALURU-560109
TENTATIVE CALENDAR OF EVENTS: II EVEN SEMESTER (2023-2024)
SESSION: MAR TO JUNE 2024

Week No.	Month	Day						Days	Activities
		Mon	Tue	Wed	Thu	Fri	Sat		
1	MAR			6*	7	8 II	9 TA	3	6*-Commencement of II sem 8- Maha Shivratri 9- Tuesday Time Table
2	MAR	11	12	13	14	15	16 DH	5	
3	MAR	18	19	20	21	22	23	6	23 - Friday Time Table
4	MAR	25	26	27	28	29 II	30	5	29- Good Friday 30 - Monday Time Table
5	APR	1	2	3	4	5 TA	6 DH	5	
6	APR	8	9 II	10	11 II	12	13ASD	4	9 - Ugadi 11 - Kutub A Ramzan 13-Tuesday Time Table
7	APR	15T1	16T1	17T1	18	19	20 DH	5	
8	APR	22	23BV	24	25* FFBI	26	27	6	27- Wednesday Time Table 25 - First Faculty Feed Back
9	APR/MAY	29	30	1 II	2	3	4 DH	4	1- May Day
10	MAY	6	7	8	9	10 II	11	5	10 - Basava Jayanthi 11- Friday Time Table
11	MAY	13	14	15	16	17ASD	18 DH	5	
12	MAY	20T2	21T2	22T2	23	24	25	6	25-Monday Time Table
13	MAY/ JUNE	27BV	28	29	30	31*FFB-II	1 DH	5	31 - Second Faculty Feed Back
14	JUNE	3	4	5	6	7	8	6	8-Monday Time Table
15	JUNE	10	11	12	13	14	15 DH	5	
16	JUNE	17II	18	19	20T3	21T3	22T3	5	17-Bakrid
17	JUNE	24LT	25LT	26LT	27LT	28BV	29*	6	29-Tuesday Time Table 29* last working

Total No of Working Days : 86

Total Number of working days (Excluding holidays and Tests)=73

H	Holiday
BV	Blue Book Verification
T1,T2,T3	Tests 1,2,3
ASD	Attendance & Sessional Display
DH	Declared Holiday
LT	Lab Test
TA	Test attendance

Monday	15
Tuesday	15
Wednesday	14
Thursday	14
Friday	15
Total	73

SIGNATURE OF PRINCIPAL
Dr. K. RAMA NARASIMHA
Principal/Director
K.S. School of Engineering and Management
Bengaluru - 560 109

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU-560109

DEPARTMENT OF APPLIED SCIENCE

SESSION: 2023-2024 (EVEN SEMESTER)

CLASS TIME TABLE (Chemistry Cycle)

(W.E.F. 06-03-2024)

Class: II-A (CSE) Lecture Hall: A113 Class Teacher: Dr.Anitha R

DAY	8.40-9.35	9.35-10.30	10.30-10.45	10.45-11.40	11.40-12.35	12.35-1.20	1.20-2.10	2.10-3.00	3.00-3.50
MONDAY	BESCK204A (NSP)	BPLCK205B (PMR)	TEA BREAK	BCHES202 (Dr. AR)	BMATS201 (Dr. CV)	LUNCH BREAK	BCHES202 (Dr. AR)	BCEDK203 Theory (Dr.SA)	
TUESDAY	A1 BATCH (BMATS201 -NTK,RD-A403B-4th Floor) A2 BATCH (BPLCK205B-PMR,PN-LAB NO.003)				BPWSK206 (SM)		BESCK204A (NSP)	BKSKK207/ BKBKK207 (TR)	BIDTK258 (SMP)
WEDNESDAY	BPLCK205B (PMR)	BMATS201 (Dr. CV)	TEA BREAK	BCHES202 (Dr. AR)	BESCK204A (NSP)		A1 BATCH (BPLCK205B-PMR,PN-LAB NO.003) A2 BATCH (BCHES202- Dr. AR, Dr.SS)		
THURSDAY	BCEDK203 - Lab (Dr.SA)				BMATS201 (Dr. CV)		A1 BATCH (BCHES202-Dr.AR, Dr.HRR) A2 Library		
FRIDAY	BCHES202 (Dr.AR)	BMATS201 (Dr. CV)	TEA BREAK	BESCK204A (NSP)	BPLCK205B (PMR)		A1 Library A2 BATCH (BMATS201 -NTK, RD-A403B-4th Floor)		
SATURDAY	AS PER CALENDAR OF EVENTS						AS PER CALENDAR OF EVENTS		

CODE	SUBJECT	HOURS /WEEK	STAFF
BMATS201	Mathematics For CSE Stream-II	4+3	Theory: Dr. C Vasudev (Dr. CV), Lab: Mrs. Nagarathna T K (NTK), Mrs. Divya.R (RD), Dr. C Vasudev (Dr.CV)
BCHES202	Chemistry For CSE Stream	4+3	Theory: Dr. Anitha R (Dr. AR), Lab: Dr. Anitha R (Dr.AR), Dr. Swarna. S (Dr.SS), Dr. H R Radha (Dr. HRR)
BCEDK203	Computer-Aided Engineering Drawings	2+3	Dr. Srinidhi Acharya (Dr. SA)
BESCK204A	Introduction To Civil Engineering	4	Mr. Shashiprad N (NSP)
BPLCK205B	Introduction to Python Programming	3+3	Ms. Punitha M R (PMR) Lab: PMR, PN
BPWSK206	Professional Writing Skill In English	1	Mrs. Sindhushree M S (SM)
BKSKK207/ BKBKK207	Samskrutika Kannada/ Balake Kannada	1	Mr. Thrimurthy (TR)
BIDTK258	Innovation and Design Thinking	1	Mr. Sasiadran M Prabhu (SMP)

Anitha. S.Y
Time -table Co-ordinator

Head of the Department 04/03/24
Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management
Bangalore - 560 109

Principal
Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Management
Bengaluru - 560 109

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU-560109
DEPARTMENT OF APPLIED SCIENCE
SESSION: 2023-2024 (EVEN SEMESTER)
INDIVIDUAL TIME TABLE
(W.E.F-06/03/2024)

Faculty Name: Dr. Anitha R

DAY	8.40-9.35	9.35-10.30	10.30-10.45	10.45-11.40	11.40-12.35	12.35-1.20	1.20-2.10	2.10-3.00	3.00-3.50
MONDAY			TEA BREAK	BCHES202 (Dr. AR)		LUNCH BREAK	BCHES202 (Dr. AR)		
TUESDAY									
WEDNESDAY	C1 BATCH- (BCHES202 (Dr. HRR, Dr. AR)			BCHES202 (Dr. AR)			D1 BATCH- BCHES202 (Dr. HRR, Dr. AR)		
THURSDAY	B2 BATCH (BCHES202-Dr.SS, Dr.AR)						A2 BATCH (BCHES202- Dr. AR, Dr.SS)		
FRIDAY	BCHES202 (Dr.AR)						A1 BATCH (BCHES202-Dr.AR, Dr.HRR)		
SATURDAY	AS PER CALENDAR OF EVENTS								
							AS PER CALENDAR OF EVENTS		

CODE	SUBJECT	HOURS /WEEK
BCHES202	Chemistry For CSE Stream	4
BCHES202	Chemistry Lab	5

Vinutha. S.Y
Time -table Co-ordinator

Head of the Department
Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management
Bangalore - 560 109

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Dr. K. RAMA NARASIMHA
Principal/Director
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K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU-560109

DEPARTMENT OF APPLIED SCIENCE

SESSION: 2023-2024 (EVEN SEMESTER)

LAB TIME TABLE

(W.E.F-06/03/2024)

Lab No.: A112

LAB INCHARGE:- Dr. ANITHA R

Instructor: Avinash R

DAY	8.40-9.35	9.35-10.30	10.30-10.45	10.45-11.40	11.40-12.35	12.35-1.20	1.20-2.10	2.10-3.00	3.00-3.50
MONDAY			TEA BREAK			LUNCH BREAK	B1 BATCH (BCHES202-Dr.SS,Dr.HRR)		
TUESDAY							D1 BATCH- BCHEM202 (Dr. HRR, Dr. AR)		
WEDNESDAY	C1 BATCH- (BCHES202 (Dr. HRR, Dr. AR)						A2 BATCH (BCHES202- Dr. AR, Dr.SS)		
THURSDAY	B2 BATCH (BCHES202-Dr.SS, Dr.AR)						A1 BATCH (BCHES202-Dr.AR, Dr.HRR)		
FRIDAY			TEA BREAK				C2 BATCH - BCHES202 (Dr. HRR, Dr. SS)		
SATURDAY	AS PER CALENDAR OF EVENTS						AS PER CALENDAR OF EVENTS		

Vinutha. S.V
Time -table Co-ordinator

05/08/2024
Head of the Department

Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Manageme..
Bangalore - 560 109

Principal

Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Management
Bengaluru - 560 109

K. S. SCHOOL OF ENGINEERING & MANAGEMENT, Bengaluru- 560109

Semester- II	Chemistry group , With effect from 06.03.2024		Year:2023-24	
Section: A	Branch: CSE		Room No. A 113	
Sl. No	USN	Student Name	Mentors	Class Teacher	Lab Batches
1	1KG23CS001	A YASHWITHA	Dr. VASUDEV C	Dr. ANITHA R	BATCH - 1
2	1KG23CS003	ADITYA H			
3	1KG23CS004	ADITYA F MASABINAL			
4	1KG23CS005	AJITH KUMAR			
5	1KG23CS006	AKASH S			
6	1KG23CS007	AKHIL GOUTHAM K			
7	1KG23CS008	AMAR	Dr. ANITHA R		
8	1KG23CS009	AMRUTHA K			
9	1KG23CS010	ANKITHA P			
10	1KG23CS011	ANUSHA M N			
11	1KG23CS013	ASHWINI N R			
12	1KG23CS014	BHARATH KUMAR S C			
13	1KG23CS015	BHASKAR S			
14	1KG23CS016	BHAVYA SAI SHREE V			
15	1KG23CS017	C YUVARAJ			
16	1KG23CS018	CHAITHANYA C GOWDA			
17	1KG23CS019	CHAITHANYA R			
18	1KG23CS020	CHALLA BALAJI NAIDU			
19	1KG23CS021	CHITRA U			
20	1KG23CS022	D JAYA KRISHNA			
21	1KG23CS023	D YASHWANTH			
22	1KG23CS024	DEEKSHA N			
23	1KG23CS025	DEEKSHITHA K			
24	1KG23CS027	DHEERAJ R			
25	1KG23CS029	DIVIT V			
26	1KG23CS030	DYUTHI S	Ms.RASHMI G N		
27	1KG23CS031	G DAEWOO SRI PRASAD			
28	1KG23CS032	GABBURI NARASANNA PALLAVI			
29	1KG23CS033	GADDAMADUGU DINAVYA			
30	1KG23CS035	GANNI NAVEEN RAJ ANUDEEP			
31	1KG23CS036	H VISHNU			
32	1KG23CS037	HARI NARAYANA S			
33	1KG23CS039	HARSHITHA S			
34	1KG23CS040	IMPANA P			
35	1KG23CS041	INCHARA S			
36	1KG23CS042	ISMATH ZEHERA			
37	1KG23CS043	JANHAVI SUDHAKAR THORAT			
38	1KG23CS044	JHANAVI C			
39	1KG23CS046	K BINDU			
40	1KG23CS047	K DHEERAJ CHOWDARY			
41	1KG23CS048	K G SOUMYA			
42	1KG23CS049	K P NIHAAL			
43	1KG23CS050	K YESHWANTH CHOWDARY			
44	1KG23CS051	KAMBHAMPATI VEDAVYAS	Ms. PUNITHA M R		BATCH - 2
45	1KG23CS052	KARANAM VENNELA			
46	1KG23CS054	KIRAN S			
47	1KG23CS055	KOTHA HARSHA NANDHAN			
48	1KG23CS056	KUSHAL K R			
49	1KG23CS057	LAKSHMI B			
50	1KG23CS058	LALITH ADITHYA M			
51	1KG23CS060	LISHANTH N			
52	1KG23CS062	M HARSHITH PRAMOD			
53	1KG23CS063	M NEVARUTH SAI			
54	1KG23CS066	MALLIKARJUNA BIRADAR			
55	1KG23CS068	MANOJ KUMAR C			
56	1KG23CS069	MANYA B M			
57	1KG23CS071	MEGHA			
58	1KG23CS078	PARSHURAM N			
59	1KG23CS090	RISHMITHA K B			
60	1KG23CS091	S AKSHATHA			
61	1KG23CS098	SHASHIDHARA S C			
62	1KG23CS106	SOURABH GOUD ALLOLLI			
63	1KG23CS112	VAIBHAVI S			

05/03/2024

Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management
Bangalore - 560 109

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU - 560109
DEPARTMENT OF APPLIED SCIENCE
SESSION: 2023-2024 (EVEN SEMESTER)

LESSON PLAN

NAME OF THE STAFF: Dr. ANITHA R.

COURSE CODE/TITLE: BCHES202/ APPLIED CHEMISTRY FOR COMPUTER SCIENCE AND ENGINEERING STREAM

SEMESTER/YEAR : II SEM/I

Sl. No.	Topic to be covered	Mode of Delivery	Teaching Aid	No. of Periods	Cumulative No. of Periods	Proposed Date	Delivery Date
	MODULE 1: Corrosion and Electrode System						
1	**Corrosion Chemistry:** Introduction, electrochemical theory of corrosion	L+ I	BB	1	1	6/3/24	13/3/24
2	Types of corrosion- differential metal and differential aeration, Corrosion control-galvanization, anodization and sacrificial anode method	L+ I	BB+PPT	1	2	11/3/24	14/3/24
3	Corrosion Penetration Rate (CPR) – Introduction and numerical problem.	L + PS	BB	1	3	11/3/24	15/3/24
4	**Electrode System:** Introduction, types of electrodes. Ion selective electrode– definition, construction, working and applications of glass electrode.	L+ I	BB	1	4	13/3/24	18/3/24
5	Determination of pH using glass electrode.	L+ I	BB+PPT	1	5	15/3/24	18/3/24
6	Reference electrode-Introduction, calomel electrode–construction, working and applications of calomel electrode.	L+ I	BB	1	6	18/3/24	19/3/24
7	Concentration cell– Definition, construction and Numerical problems.	L+ PS	BB	1	7	18/3/24	20/3/24
8	**Analytical Techniques:** Introduction, principle and instrumentation of Conductometry; its application in the estimation of weak acid. Potentiometry; its application in the estimation of iron.	L+AV	BB+PPT	1	8	20/3/24	22/3/24
9	**Tutorials:** numerical problems on CPR	L+ PS	BB	0	8	22/3/24	25/3/24
10	**Tutorials:** explained Analytical Techniques.	L	BB	0	8	23/3/24	25/3/24
11	**Self-Study:** IR and UV-Visible spectroscopy.	Books & Online materials	Interacti on	0	8	25/3/24	26/3/24
	Practical Component						

12	**1) Practicals:** Potentiometric estimation of FAS using $K_2Cr_2O_7$	Experimentation +D	Lab experimental kit + D	1 lab slot=3 Periods	3	A2-Batch 6/3/24 A1-Batch 15/3/24	13/3 14/3
13	**2) Practicals:** Determination of pKa of vinegar using pH sensor (Glass electrode)	Experimentation +D	Lab experimental kit + D	3	6	A2-Batch 13/3/24 A1-Batch 22/3/24	20/3 21/3/24
14	**3) Practicals:** Estimation of iron in TMT bar by diphenyl amine/external indicator method.	Experimentation +D	Lab experimental kit + D	3	9	A2-Batch 20/3/24 A1-Batch 23/3/24	27/3 28/3/24
	MODULE 2: Polymers and Green Fuels						
15	Polymers: Introduction Molecular weight- Number average	L+I	BB	1	9	25/3/24	30/3/24
16	Weight average and numerical problems.	L+ PS	BB	1	10	27/3/24	1/4
17	Weight average and numerical problems.	L+ PS	BB	1	11	30/3/24	2/4/24
18	Weight average and numerical problems.	L+ PS	BB	1	12	30/3/24	3/4/24
19	Preparation properties and commercial applications of kevlar.	L+I	BB+PPT	1	13	1/4/24	3/4/24
20	Synthesis and conducting mechanism of polyacetylene and commercial applications.	L+I	BB+PPT	1	14	1/4/24	5/4/24
21	Green Fuels: Introduction, construction and working of solar photovoltaic cell, advantages and disadvantages.	L+I	BB	1	15	3/4/24	8/4/24
22	Generation of energy (green hydrogen) by electrolysis of water and its advantages.	L+AV	BB+PPT	1	16	5/4/24	8/4/24
23	**Tutorials:** numerical problems.	L+ PS	BB	0	16	8/4/24	10/4/24
24	**Tutorials:** mechanism of polyacetylene	L+I	BB	0	16	8/4/24	12/4/24
25	**Self-Study:** Regenerative fuel cells	Books & Online materials	Interaction	0	16	10/4/24	15/4/24
26	Assignment-1	----	----	----	----	25/3/24	—
	Practical Component						
27	**4) Demonstrative experiment:** Electrolysis of water	Experimentation +D	Lab experimental kit + D	3	12	A2-Batch 27/3/24 A1-Batch 5/4/24	3/4/24 4/4/24
	MODULE 3: Sensors and Energy Systems						
28	Sensors: Introduction, working, principle and applications of Conductometric sensors	L+ I	BB	1	17	12/4/24	15/4/24

	Electrochemical sensors, thermometric sensors (Flame photometry) and Optical sensors (colorimetry)	L+I	BB+PPT	1	18	19/4/24	18/4/24
30	Sensors for the measurement of dissolved oxygen (DO). Electrochemical sensors for the pharmaceuticals	L+I	BB+PPT	1	19	22/4/24	19/4/24
31	Electrochemical gas sensors for Sox and NOx	L+I	BB+PPT	1	20	22/4/24	19/4/24
32	Disposable sensors in the detection of biomolecules and pesticides.	L+AV	BB+PPT	1	21	24/4/24	25/4/24
33	Energy Systems: Introduction to batteries, construction, working and applications of Lithium ion	L+I	BB	1	22	26/4/24	29/4/24
34	Working and applications of Lithium ion and Sodium ion batteries	L+I	BB+PPT	1	23	27/4/24	29/5/24
	Quantum Dot Sensitized Solar Cells (QDSSC's)-Principle, Properties and Applications.	L+I	BB	1	24	29/4/24	11/5/24
36	**Tutorials:** gas sensors for Sox and NOx	L+I	BB	0	24	29/4/24	11/5/24
37	**Tutorials:** Lithium ion batteries.	L+I	BB	0	24	3/5/24	13/5/24
38	**Self-Study:** Types of electrochemical sensor, Gas sensor - O_2 sensor, Biosensor – Glucose sensors	Books & Online materials	Interacti on	0	24	6/5/24	13/5/24
	Practical Component						
39	5) **Practicals:** Conductometric estimation of acid mixture.	Experimen tation +D	Lab experiment al kit + D	3	15	A2-Batch 3/4/24 A1-Batch 12/4/24	10/4/24 18/4/24
	6) **Practicals:** Estimation of Copper present in electroplating effluent by optical sensor (colorimetry)	Experimen tation +D	Lab experiment al kit + D	3	18	A2-Batch 10/4/24 A1-Batch 19/4/24	17/4/24 25/4/24
41	7) **Practicals:** Estimation of total hardness of water by EDTA method.	Experimen tation +D	Lab experiment al kit + D	3	21	A2-Batch 24/4/24 A1-Batch 26/4/24	15/5/24 2/5/24
42	8) **Open ended experiments:** Design an experiment to identify the presence of proteins in given sample.	Guiding the students to perform	Lab experiment al kit	3	24	A2-Batch 27/3/24 A1-Batch 3/5/24	22/5/24 16/5/24
43	9) **Open ended experiments:** Searching suitable PDB file and target for molecular docking.	Guiding the students to perform	Lab experiment al kit	3	27	A2-Batch 8/5/24 A1-Batch 11/5/24	23/5/24 6/6/24
4	Assignment-2	----	----	----	----	27/4/24	—

MODULE 4: Materials for Memory and Display Systems

45	Memory Devices: Introduction, Basic concepts of electronic memory, History of organic/polymer electronic memory devices.	L+I	BB+PPT	1	25	6/5/24	
46	Classification of electronic memory devices.	L+I	BB+PPT	1	26	8/5/24	
47	Types of organic memory devices (organic molecules, polymeric materials, organic- inorganic hybrid materials).	L+I	BB+PPT	1	27	11/5/24	
48	Display Systems: Photoactive and electro active materials.	L+I	BB+PPT	1	28	13/5/24	
49	Nanomaterials and organic materials used in optoelectronic devices.	L+I	BB+PPT	1	29	13/5/24	
50	Liquid crystals (LC's) - Introduction, classification, properties and application in Liquid Crystal Displays (LCD's)	L+ AV	BB	1	30	15/5/24	
51	Properties and application of Organic Light Emitting Diodes (OLED's).	L+I	BB	1	31	17/5/24	
52	Quantum Light Emitting Diodes (QLED's), Light emitting electrochemical cells.	L+I	BB	1	32	24/5/24	
53	**Tutorials:** Explained the applications of QLED's	L+I	BB	0	32	25/5/24	
54	**Tutorials:** Explained the applications of OLED's	L+I	BB	0	32	25/5/24	
55	**Self-Study:** Properties and functions of Silicon (Si), Germanium (Ge), Copper (Cu), Aluminium (Al), and Brominated flame retardants in computers	Books & Online materials	Interacti on	0	32	27/5/24	
	Practical Component						
56	**10) Demonstrative experiment:** Synthesis of Iron-oxide nanoparticles.	Experimen tation +D	Lab experiment al kit	3	30	A2-Batch 15/5/24 A1-Batch 17/5/24	
	MODULE 5: E-Waste Management						
57	E-Waste: Introduction, sources of e-waste, Composition,	L+I	BB+PPT	1	33	27/5/24	
58	Characteristics and Need of e- waste management.	L+I	BB+PPT	1	34	29/5/24	
59	Toxic materials used in manufacturing electronic and electrical products, health hazards due to exposure to e-waste.	L+I	BB+PPT	1	35	31/5/24	
60	Recycling and Recovery: Different approaches of recycling: separation, thermal treatments.	L+ AV	BB+PPT	1	36	3/6/24	
61	Hydrometallurgical extraction.	L+ AV	BB+PPT	1	37	3/6/24	

	pyro metallurgical methods, direct recycling.	L+ I	BB+PPT	1	38	5/6/24	7/6/24
63	Extraction of gold from E-waste.	L+ I	BB+PPT	1	39	7/6/24	8/6/24
64	Role of stakeholders in environmental management of e-waste (producers, consumers, recyclers, and statutory bodies)	L+ I	BB+PPT	1	40	8/6/24	10/6/24
65	**Tutorials:** Different approaches of recycling.	L+ I	BB	0	40	8/6/24	11/6/24
66	**Tutorials:** Extraction of gold from E-waste.	L+ I	BB	0	40	10/6/24	12/6/24
67	**Self-Study:** Impact of heavy metals on environment and human health.	Books & Online materials	Interacti on	0	40	10/6/24	12/6/24
68	**Revision**	L	BB	0	40	12/6/24	13/6/24
	Revision and mqp solving	L	BB	0	40	14/6/24	14/6/24
70	**Revision and mqp solving**	L	BB	0	40	19/6/24	24/6/24
71	**Revision and mqp solving**	L	BB	0	40	28/6/24	
	Practical Component						
72	**11) Practicals:** Determination of Chemical Oxygen Demand (COD) of industrial waste water sample.	Experimen tation +D	Lab experiment al kit + D	3	33	A2-Batch 29/5/24 A1-Batch 24/5/24	12/6/24 20/6/24
73	**12) Practicals:** Determination of Viscosity coefficient of lubricant (Ostwald's viscometer)	Experimen tation +D	Lab experiment al kit + D	3	36	A2-Batch 5/6/24 A1-Batch 31/5/24	19/6/24 26/6/24

	Mode of Assignments and Instructions	Date
Assignment 1	Written Assignment	25/03/24
Assignment 2	Written Assignment	27/04/24

Total No. of Lecture Hours = 40
Total No. of Tutorial Hours = 10
Total No. of Self-study Hours = 5
Total no. of Practical Hours = 36
Total no. of Practical Classes = 12
Total no. of Revision Hours = 4

ourse In charge

Head of the Department
Dr. C. VASUDEV
Professor & HOD

Principal
Dr. K. RAMA NARASIMHA
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DEPARTMENT OF APPLIED SCIENCE
APPLIED CHEMISTRY FOR COMPUTER SCIENCE STREAM

Question Bank (BCHES102/202)

MODULE- I

Sensors and Energy Systems

1. Explain the working principle of Conductometric sensors (conductometry), and Optical sensors (colorimetry).
2. What are Electrochemical Sensors? Explain its application in the measurement of Dissolved Oxygen (DO)
3. Explain optical sensor for measurement of Dissolved Oxygen (DO).
4. Explain Electrochemical sensor for measurement of Dissolved Oxygen (DO).
5. Explain the working principle of Electrochemical sensors, and mention its applications.
6. Describe the construction, working and applications of Lithium-ion batteries and mention any four applications.
7. Describe the application of Electrochemical sensors in sensing Diclofenac (DCF).
8. Describe the application of Electrochemical sensors in sensing hydrocarbons-1-hydroxy pyrene.
9. Explain the working principle of Electrochemical sensors, and mention its applications.
10. Describe the application of Electrochemical gas sensors in sensing SOx and NOx.
11. What are Quantum Dot Sensitized Solar Cells (QDSSC's)? Explain the working Principle, Properties and Applications.
12. What are batteries? Explain the working Principle, Properties and Applications of Quantum Dot sensitized solar cells.
13. Write a note on Disposable Sensors? Explain its advantages over classical sensors.
14. Explain about detection of Ascorbic acid with electrochemical oxidation.
15. Explain about detection of Glyphosate with electrochemical oxidation.
16. Describe the construction, working and applications of Sodium-ion batteries and mention any four applications.
17. What are Actuators & Transducers? Explain about detection of Glyphosate with electrochemical oxidation.

Question Bank (BCHES102/202)

MODULE- II

Materials for Memory and Display Systems

1. Explain the types of organic memory devices by taking p-type and n-type semiconductor materials.
2. What are optoelectronic devices? Explain the working principle of Optoelectronic device.
3. Explain any four properties and applications of Silicon nanocrystals suitable for optoelectronic devices.
4. What are photoactive and electroactive materials and explain their working principle in display system.
5. What are nanomaterials? Explain any four properties of Polythiophenes (P3HT) suitable for optoelectronic devices.
6. What are nanomaterials? Explain any four properties of Poly[9- vinylcarbazole] (PVK) suitable for optoelectronic devices.
7. What are Memory Devices? Explain the Classification of electronic memory devices with examples.
8. Mention any four properties and applications of LC-displays.
9. What are OLEDs? Explain the working principle and properties of OLED. Mention its applications.
10. What are QLEDs? Explain the working principle and properties of QLED. Mention its applications.
11. Write a note on (a) Nematic liquid crystal, (b) Smectic liquid crystal
12. What are liquid crystals? How liquid crystals are classified?
13. Discuss the working of Liquid Crystal Display.
14. What are LECs? Explain the working principle and properties of LECs. Mention its applications.

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APPLIED CHEMISTRY FOR COMPUTER SCIENCE STREAM

Question Bank (BCHES102/202)

MODULE- III

Corrosion and Electrode System

1. Define metallic corrosion? Describe the electrochemical theory of corrosion taking iron as an example.
2. Explain: (i) Differential metal corrosion & (ii) Water-line corrosion.
3. Explain differential aeration corrosion with suitable example.
4. Describe galvanizing and mention its applications.
5. Explain: i) corrosion control by Anodization & ii) Sacrificial anodic method.
6. What are reference electrodes? Explain the construction and working of Calomel electrode.
7. Explain the construction and working of glass electrode.
8. What is an Electrode? Discuss the different types of electrodes with example.
9. Discuss the determination of pH using glass electrode.
10. What are concentration cells? Write a note on Electrolyte concentration cells.
11. Define corrosion? Mention at least six implications of corrosion.
12. Explain the application of conductometric electrode in estimation of weak acid.
13. Discuss the theory, instrumentation and application for the estimation of weak acid using conductometry.
14. Discuss the theory, instrumentation and application for the estimation of iron using potentiometry.

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APPLIED CHEMISTRY FOR COMPUTER SCIENCE STREAM

Question Bank (BCHES102/202)

MODULE- IV

Polymers And Green Fuels

1. A polydisperse sample of polystyrene is prepared by mixing three monodisperse samples in following proportions. 1g of 10000 molecular weight, 2g of 50000 molecular weight and 2g 100000 molecular weight. Determine number average and weight average molecular weight. F the index of polydispersity.

2. In a polymer sample, 20% of molecules have molecular mass 15000g/mol, 45% molecules have molecu mass 25000g/mol remaining molecules have molecular mass 27000g/mol. Calculate the number avera weight average molecular mass and PI of the polymer.

3. Define Polymerization, Number-average molecular weight (M_n) and Weight-average molecul weight (M_w).

4. What are conducting polymers? Explain the synthesis of Polyacetylene and mention its applications

5. Explain the reaction mechanism conduction in Polyacetylene by oxidative doping.

6. Explain the reaction mechanism conduction in Polyacetylene by reductive doping.

7. Explain the generation of hydrogen by Alkaline water electrolysis.

8. Describe the hydrogen production by photo catalytic water splitting method.

9. What are Polymer composites? Explain the preparation, properties, and commercial applications of Kevlar.

10. Explain the preparation, properties and commercial applications of Graphene Oxide.

11. Explain the construction and working of photovoltaic cells.

12. What are green fuels? Explain the advantages & disadvantages of photovoltaic cells.

13. Mention the properties of hydrogen pertaining to fuel and its advantages in production of energy.

14. What are green fuels? Explain the different types of fuel.

15. Explain the generation of hydrogen by alkaline water electrolysis.

16. Explain the generation of hydrogen by PEM water electrolysis.

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT,
BENGALURU-560109
DEPARTMENT OF APPLIED SCIENCE
APPLIED CHEMISTRY FOR COMPUTER SCIENCE STREAM

Question Bank (BCHES102/202)

MODULE-V

Waste Management

1. Mention the sources of e-waste and explain the need for e-waste management.
2. What is e-waste and explain the need for e-waste management.
3. Explain the recycling of e-waste.
4. Explain the advantages of recycling and recovery in e-wastes.
5. Explain the extraction of gold from e-waste.
6. Explain the ill effects of toxic materials used in manufacturing electrical and electronic products.
7. Explain the health hazard due to exposure to e-waste.
8. Explain the pyrometallurgical and direct recycling methods.
9. Explain the Hydrometallurgical method.
10. What is the role of stakeholders in the environmental management of e-waste?
11. Write a brief note on role of stakeholders for example; producers, consumers, recyclers, and statutory bodies.
12. Which all toxic materials used in manufacturing electrical and electronic products, write there effects on environment.
13. Explain about sources, composition and characteristics of e-waste.

Anitha R.

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU - 560109

DEPARTMENT OF CHEMISTRY

SESSION: 2023-2024 (EVEN SEMESTER)

CO-PO MAPPING

Course: Applied Chemistry for Computer Science & Engineering stream

Type: Core (Theory/Practical/Integrated) | **Course Code:** BCHES202

No of Hours			
Theory (Lecture Class)	Practical/Field Work/Allied Activities	Total/Week	Total teaching hours
4	3	7 (4 + 3)	76 (40 + 36)

Marks			
Internal Assessment	Examination	Total	Credits
50	50	100	4

Aim/Objectives of the Course

1. To enable students to acquire knowledge on principles of chemistry for engineering applications.
2. To develop an intuitive understanding of chemistry by emphasizing the related branches of engineering.
3. To provide students with a solid foundation in analytical reasoning required to solve societal problems.

Course Learning Outcomes

After completing the course, the students will be able to

CO1	**Utilize** various concepts of chemistry for corrosion control and to analyze engineering materials.	Applying (K3)
CO2	**Make use** of different techniques for the production of green fuels and also able to determine molecular weight of a polymer.	Applying (K3)
CO3	**Utilize** the principle of electrochemical and optical sensors for the estimation of different components in the analyte.	Applying (K3)
CO4	**Utilize** the properties of Liquid Crystal, Organic Light Emitting Diodes and Quantum Light emitting diodes to Illustrate the working mechanism of display systems.	Applying (K3)
CO5	**Apply** the concepts of various recycling and extraction techniques in the e-waste management	Applying (K3)

Syllabus Content

MODULE 1: Corrosion and Electrode System **Corrosion Chemistry:** Introduction, electrochemical theory of corrosion, types of corrosion- differential metal and differential aeration. Corrosion control - galvanization, anodization and sacrificial anode method. Corrosion Penetration Rate (CPR) - Introduction and numerical problem. **Electrode System:** Introduction, types of electrodes. Ion selective electrode – definition, construction, working and applications of glass electrode. Determination of pH using glass electrode. Reference electrode- Introduction, calomel electrode– construction, working and applications of calomel electrode. Concentration cell– Definition, construction and Numerical problems.	CO1 8 hrs PO1-3 PO2-3 PO3-1 PO5-1 PO6-1

Analytical Techniques: Introduction, principle and instrumentation of Conductometry; its application in the estimation of weak acid. Potentiometry; its application in the estimation of iron. **Self-learning:** IR and UV-Visible spectroscopy. **Practical Component:** 1. Conductometric estimation of acid mixture 2. Potentiometric estimation of FAS using $K_2Cr_2O_7$ 3. Determination of pKa of vinegar using pH sensor (Glass electrode) 4. Estimation of total hardness of water by EDTA method **LO:** At the end of this session the student will be able to 1. Utilize the concept of electrochemical theory of corrosion to illustrate various types of corrosion and its control. Also, able to determine corrosion penetration rate of metals at different corrosive medium. 2. Derive an expression for P^H using glass electrode and determine E_{cell} of concentration cell. 3. Make use of principle and instruments of electrochemical and optical sensors for sample analysis.	PO7-2 PO9-3 PO12-1 PSO1-2 PSO2-1
MODULE 2: Polymers and Green Fuels **Polymers**: Introduction, Molecular weight: Number average, weight average and numerical problems. Preparation, properties, and commercial applications of Kevlar fiber. Conducting polymers– synthesis and conducting mechanism of polyacetylene and commercial applications. **Green Fuels:** Introduction, construction and working of solar photovoltaic cell, advantages, and disadvantages. Generation of energy (green hydrogen) by electrolysis of water and its advantages. **Self-learning:** Regenerative fuel cells. **Practical Component:** 1. Determination of Viscosity coefficient of lubricant (Ostwald's viscometer). **LO:** At the end of this session the student will be able to 1. Apply electrolysis concept in the production of hydrogen 2. Find Number average and Weight average Molecular weight of polymers to know the nature of polymer. 3. Explain working and applications of P.V. cell	CO2 8 hrs PO1-3 PO2-3 PO3-1 PO5-1 PO6-1 PO7-1 PO9-1 PO12-1 PSO1-2 PSO2-1
MODULE 3: Sensors and Energy Systems **Sensors:** Introduction, working, principle and applications of Conductometric sensors, Electrochemical sensors, Thermometric sensors (Flame photometry) and Optical sensors (colorimetry). Sensors for the measurement of dissolved oxygen (DO). Electrochemical sensors for the pharmaceuticals. Electrochemical gas sensors for Sox and NOx . Disposable sensors in the detection of biomolecules and pesticides. **Energy Systems:** Introduction to batteries, construction, working and applications of Lithium ion and Sodium ion batteries. Quantum Dot Sensitized Solar Cells (QDSSC's)-Principle, Properties and Applications. **Self-learning**: Types of electrochemical sensor, Gas sensor - O_2 sensor, Biosensor – Glucose sensors. **Practical Component:** 1. Estimation of iron in TMT bar by external indicator method. 2. Determination of Chemical Oxygen Demand (COD) of industrial waste water sample. 3. Determination of strength of an acid in Pb-acid battery. **LO:** At the end of this session the student will be able to 1. Apply redox reaction concept to illustrate the working of batteries. 2. Make use of principle and instruments of electrochemical and optical sensors for sample analysis.	CO3 8 hrs PO1-3 PO2-3 PO3-1 PO5-1 PO6-1 PO7-1 PO8-1 PO9-3 PO12-1 PSO1-2 PSO2-1

3. Determine strength of an acid in Pb-acid battery.	
MODULE 4: Materials for Memory and Display Systems **Memory Devices:** Introduction, Basic concepts of electronic memory, History of organic/polymer electronic memory devices, Classification of electronic memory devices, types of organic memory devices(organic molecules, polymeric materials, organic, inorganic hybrid materials). **Display Systems:** Photoactive and electroactive materials, Nanomaterials and organic materials used in optoelectronic devices. **Liquid crystals (LC's)** - Introduction, classification, properties and application in Liquid Crystal Displays (LCD's). Properties and application of Organic Light Emitting Diodes (OLED's) and Quantum Light Emitting Diodes (QLED's). Light emitting electrochemical cells. **Self-learning:** Properties and functions of Silicon (Si), Germanium (Ge), Copper (Cu), Aluminium (Al),and Brominated flame retardants in computers. **Practical Component:** 1. Synthesis of iron oxide nanoparticles. **LO:** At the end of this session the student will be able to 1. Classify different types of memory devices. 2. Utilize the properties of Liquid Crystal, Organic Light Emitting Diodes and Quantum Light emitting diodes to Illustrate the working mechanism of display systems.	CO4 8 hrs PO1-3 PO2-3 PO3-1 PO5-1 PO6-1 PO7-1 PO9-3 PO12-1 PSO1-2 PSO2-1
MODULE 5: E-Waste Management E-Waste: Introduction, sources of e-waste, Composition, Characteristics, and Need of e-waste management. Toxic materials used in manufacturing electronic and electrical products, health hazards due to exposure to e-waste. Recycling and Recovery: Different approaches of recycling (separation, thermal treatments, hydrometallurgical extraction, pyro metallurgical methods, direct recycling). Extraction of gold from E-waste. Role of stakeholders in environmental management of e-waste (producers, consumers, recyclers, and statutory bodies). Self-learning: Impact of heavy metals on environment and human health. **Practical Component:** 2. Estimation of metal in e-waste by optical sensors. **LO:** At the end of this session the student will be able to 3. Explain various sources of e-waste 4. Apply various recycling and extraction techniques in the e-waste management.	CO5 8 hrs PO1-3 PO2-3 PO3-1 PO5-1 PO6-1 PO7-3 PO9-1 PO12-1 PSO1-2 PSO2-1

Text Books

1. Basuchandra's Applied Chemistry for Electrical and Electronic Engineering Stream Fourth edition-2022
2. A Text Book of Engg. Chemistry, Shashi Chawla, & Co.(P)Ltd.
3. SS Dara & Dr. SS Umare. -A Text book of Engineering Chemistry, S Chand & Company Ltd., 12th Edition, 2011.
4. R.V. Gadag and Nithyananda Shetty-A Text Book of Engineering Chemistry, I.K. International Publishing house. 2nd Edition, 2019.
5. B.S. Jai Prakash, R. Venugopal, Sivakumaraiah& Pushpa Iyengar.,- Chemistry for Engineering Students", Subash Publications, Bangalore.5th Edition, 2014
6. Principles of Physical Chemistry, B.R. Puri, L.R. Sharma & M.S. Pathania, S. Nagin Chand & Co., 41 Edition, 2004.

Reference Books (specify minimum two foreign authors text books)

1. Wiley Engineering Chemistry, Wiley India Pvt .Ltd. New Delhi,2013-2ndEdition.
2. Engineering Chemistry, Satyaprakash & Manisha Agrawal, Khanna Book Publishing, Delhi
3. G.A.Ozin, A.C. Arsenault &Lud ovicoCademartiri "*Nanochemistry A Chemical Approach to Nanomaterials*", Royal Society of Chemistry, First Edition, 2005.
4. Wiley,"*Engineering Chemistry*", India Pvt. Ltd. New Delhi. Second Edition. 2013.

5. V.R.Gowariker, N.V.Viswanathan&J.Sreedhar., *"Polymer Science"*, Wiley-Eastern Ltd. New Delhi, First Edition, 1986
6. M.G.Fontana., *"Corrosion Engineering"*, Tata McGraw Hill Publishing Pvt. Ltd. New Delhi, Third Edition, 19

Weblinks and Video Lectures(e-Resources):

- http://libgen.rs/
- https://nptel.ac.in/downloads/122101001/
- https://nptel.ac.in/courses/104/103/104103019/
- https://ndl.iitkgp.ac.in/
- https://www.youtube.com/watch?v=faESCxAWR9k
- https://www.youtube.com/watch?v=TBqXMWaxZYM&list=PLyhmwFtznRhuz8L1bb3X9IbHrDMjHWWh
- https://www.youtube.com/watch?v=j5Hml6KN41I
- https://www.youtube.com/watch?v=X9GHBdyYcyo
- https://www.youtube.com/watch?v=1xWBPZnEJk8
- https://www.youtube.com/watch?v=wRAo-M8xBHM

Activity Based Learning (Suggested Activities in Class)/Practical Based learning

- https://www.vlab.co.in/broad-area-chemical-sciences
- https://demonstrations.wolfram.com/topics.php
- https://interestingengineering.com/science

Useful Journals

1. Journal of Power Sources.(www.*journals.elsevier.com/journal-of-power-sources)*
2. Journal of Alloys and Compounds.(*www.journals.elsevier.com/journal-of-alloys-and-compounds)*
3. Fuel Cells Bulletin.(*www.journals.elsevier.com/**fuel-cells-bulletin***)
4. Electrochemical Acta. (*www.journals.elsevier.com/**electrochimica-acta)***
5. European Polymer Journal. (*www.journals.elsevier.com/**european-polymer-journal***)

Teaching and Learning Methods

1. **Lecture class:** 40 hrs
2. **Practical classes:** 36

***Assignment:* 2 assignments**

Type of test/examination: Written examination/Assignment

Continuous Internal Evaluation (CIE):

1. Three Tests each of 25 Marks, in which average of best of two internals is considered and scale down to 1[illegible] marks (**Test duration:** 75 Minutes)
2. Two assignments each of 25 Marks later scale down to 10 marks
3. ***CIE for the practical component:*** On completion of every experiment in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The 15 marks are for conducting the experiment, Brief procedure writeup and preparation of the laboratory record, the other 10 marks shall be for the test conducted at the end of the semester (The laboratory test duration of 03 hours is conducted for 50 marks and scale down to 10 marks)

tal: CIE: IA Tests+ CCA+ Lab = 15+10+25= 50 Marks

mester End Exam (SEE):

ory SEE will be conducted by University as per the scheduled timetable, with common question papers for the iect (duration 03 hours)

he question paper will have ten questions. Each question is set for 20 marks.

here will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-ions), should have a mix of topics under that module. The students have to answer 5 full questions, selecting one uestion from each module.

SEE will be conducted for 100 marks (students have to answer all main questions) which will be reduced to 50 Marks.

Examination duration: 3 hrs.

CO to PO Mapping

PO1: Science and engineering Knowledge	**PO7:** Environment and Society
PO2: Problem Analysis	**PO8:** Ethics
PO3: Design & Development	**PO9:** Individual & Team Work
PO4: Investigations of Complex Problems	**PO10:** Communication
PO5: Modern Tool Usage	**PO11:** Project Mngmt & Finance
PO6: Engineer & Society	**PO12:** Lifelong Learning

PSO1: Understand fundamental and advanced concepts in the core areas of Computer Science and Engineering to analyze, design and implement the solutions for the real world problems.

PSO2: Utilize modern technological innovations efficiently in various applications to work towards the betterment of society and solve engineering problems.

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
BCHES202	K-level									—					
CO1	K3	3	3	1	-	1	1	2	-	3	-	-	1	2	1
CO2	K3	3	3	1	-	1	1	1	-	1	-	-	1	2	1
CO3	K3	3	3	1	-	1	1	1	-	3	-	-	1	2	1
CO4	K3	3	3	1	-	1	1	1	-	3	-	-	1	2	1
CO5	K3	3	3	1	-	1	1	3	1	1	-	-	1	2	1

Course In charge

Head of the Department
Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management
Bangalore - 560 109

Principal
Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Manage
Bengaluru - 560 109

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

DEPARTMENT OF APPLIED SCIENCE

SESSION: 2023-2024 (EVEN SEMESTER)

FIRST ASSIGNMENT

Degree	:	B.E	Semester	:	II
Branch	:	CSE and AI&DS	Course Code	:	BCHES202
Course Title	:	Applied Chemistry	Max Marks	:	25
Date	:	25/3/2024	Last Date for Submission	:	1/4/2024

Q. No.	Question	Marks	K-Level	CO mapping
1.	(a) **Apply** electrochemical theory to **explain** the corrosion of iron. (b) **What** is CPR? A thick brass sheet of area 400 inch^2 is exposed to moist air. After 2 years of period, it was found to experience a weight loss 375g due to corrosion. If the density of brass is 8.73g/cm^3. **Calculate** CPR in mpy and mmpy.	3	Applying K3	CO1
2.	(a) **Explain** differential metal corrosion with an example. (b) **What** are concentration cells? **Explain** an Electrolyte concentration cells by taking Copper electrode.	2	Understanding K2	CO1
3.	(a) **Explain** Waterline corrosion with an example. (b) **Explain** Pitting corrosion with an example.	2	Understanding K2	CO1
4.	(a) **Derive** an expression for P^H using glass electrode. (b) Two zinc rods are placed in 0.1M & 1M $ZnSO_4$ solution separately to form a cell. Give the electrochemical representation of the cell & **calculate** its emf.	2	Applying K3	CO1
5.	**What** are reference electrodes? **Construct** the Calomel electrode and **illustrate** the working of electrode with reactions.	2	Applying K3	CO1
6.	**What** are ion selective electrodes? **Construct** the Glass electrode and **illustrate** the working of electrode with reactions.	2	Applying K3	CO1
7.	(a) **Applying** Cathodic protection principle, **explain** corrosion control by galvanisation. (b) **Applying** Cathodic protection principle, **explain** corrosion control by sacrificial anode method with example.	2	Applying K3	CO1
8.	**Explain** the construction, **Illustrate** the working of photovoltaic cells and write advantages of the cell.	3	Applying K3	CO2
9.	(a) **Explain** the generation of hydrogen by alkaline water electrolysis. (b) **What** is green hydrogen? **Discuss** any four advantages of alkaline electrolysis of water.	4	Understanding K2	CO2
10.	**Describe** the hydrogen production by proton exchange membrane water electrolysis.	3	Understanding K2	CO2

Course Incharge

HOD 26/3/24

Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management

K.S.SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

DEPARTMENT OF CIVIL ENGINEERING

SESSION: 2023-2024 (EVEN SEMESTER)

SECOND ASSIGNMENT

Degree	:	B.E	Semester :	II
Branch	:	CSE & AI-DS	Course Code :	BCHES202
Course Title	:	Applied Chemistry for CSE Stream	Max Marks :	25
Date	:	07/05/2024	Last Date for submission :	17/05/2024

Q No.	Question	Marks	K-Level	CO mapping
1	(a). A polydisperse sample of polystyrene is prepared by mixing three monodisperse samples in the following proportions. 1g of 10000 molecular weight, 2g of 50000 molecular weight and 3g of 100000 molecular weight. **Calculate** number average and weight average molecular weight and the index of polydispersity. (b). **Explain** the synthesis of Polyacetylene and mention its applications (c). **Discuss** the conduction mechanism in polyacetylene through oxidative or reductive doping technique	5	Applying K3	CO2
2	(a).**Explain** the preparation, properties and commercial applications of Kevlar (b). **Describe** Preparation, properties, and commercial applications of graphene oxide.	5	Understanding K2	CO2
3	(a). **Explain** the working principle of Conductometric sensors (conductometry) and Optical sensors (colorimetry) (b). **What** are Electrochemical Sensors? **Explain** its application in the measurement of Dissolved Oxygen (DO) (c). **Describe** the application of Electrochemical gas sensors in sensing SOx and NOx	5	Understanding K2	CO3
4	(a). **What** are Disposable Sensors? **Explain** its advantages over classical sensors (b). **What** are Actuators & Transducers? **Explain** about detection of Glyphosate with electrochemical oxidation. (c). **What** are Batteries? **Discuss** the classification of batteries	5	Understanding K2	CO3
	(a). **Describe** the construction, working and applications of Sodium-ion batteries (b). **Explain** the construction, **Illustrate** the working and applications of Lithium-ion batteries (c). **Applying** working Principle of Quantum Dot Sensitized Solar Cells (QDSSC's) **Explain** the, Properties and Applications	5	Applying K3	CO3

Course Incharge

HOD 07/05/2024

Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

DEPARTMENT OF APPLIED SCIENCE

SESSION: 2023-2024 (EVEN SEMESTER)

I SESSIONAL TEST QUESTION PAPER

SET-A

Degree	:	B.E	USN		
Branch	:	CSE & AIML	Semester	:	II
Course Title	:	Applied Chemistry	Course Code	:	BP 102/202
Duration	:	60 Minutes	Date	:	22/4/2024
			Max Marks	:	25

Note: Answer ONE full question from each part.

Q No.	Question	Marks	K-Level	CO mapping
	PART-A			
1(a)	**Explain** differential metal corrosion with an example.	5	Understanding K2	CO1
(b)	**Construct** Calomel electrode and **illustrate** working of electrode with reactions.	5	Applying K3	CO1
(c)	A thickness of alloy sheet of area 100 inch^2 is exposed to air near the ocean. After 1 year period it was found to experience a weight loss of 35 g due to corrosion. If the density of alloy is 8.4 g/cm^3. **Calculate** the CPR in mmpy and mpy.	5	Applying K3	CO1
	OR			
2(a)	**What** is galvanization? **Explain** corrosion control by galvanization process.	5	Understanding K2	CO1
(b)	**Applying** electrochemical theory of corrosion, **Illustrate** rusting of iron with reactions.	5	Applying K3	CO1
(c)	**Define** concentration cell. The emf of the cell Cu(s)/$CuSO_4$(0.001M)//$CuSO_4$(XM)/Cu(s) is 0.0595V at 25°C, **Calculate** the value of X.	5	Applying K3	CO1
	PART-B			
3(a)	**Explain** the generation of hydrogen by alkaline water electrolysis.	5	Understanding K2	CO2
(b)	**Explain** the production of Hydrogen by Photo catalytic water splitting method.	5	Understanding K2	CO2
	OR			
4(a)	**Explain** the production of Hydrogen by PEM water electrolysis.	5	Understanding K2	CO2
(b)	**Explain** the construction, working and application of photovoltaic cell.	5	Understanding K2	CO2

Course Incharge

HOD-AS 15/04/2024

Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management

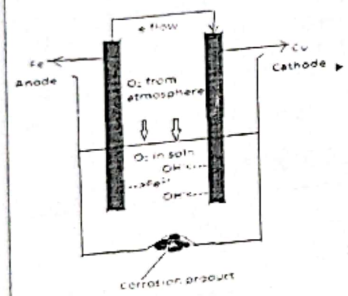
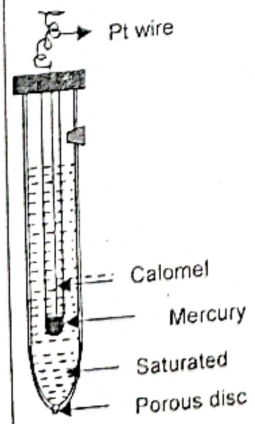
IQAC- Coordinator

Principal
Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Mana
Bangalore - 560 109

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU-560109
DEPARTMENT OF APPLIED SCIENCE
SESSION: 2023-2024 (EVEN SEMESTER)
SCHEME OF I SESSIONAL TEST QUESTION PAPER
SET- A

Degree	:	B.E	Semester	:	II
Branch	:	CSE & AIDS	Date	:	22-04-2024
Course Title	:	Applied Chemistry	Course Code	:	BCHES202
Duration	:	60 Minutes	Max Marks	:	25

Note: Answer ONE full question from each part

Q. No.	Questions with Scheme & Solution	Marks
	PART-A	
1(a)	**Explain** differential metal corrosion with an example.	5
Sol	This occurs when two dissimilar metals are in contact with each other in a corrosive conductive medium; a potential difference is set up resulting in a galvanic current. The two metals differ in their tendencies to undergo oxidation. **The metal with lower electrode potential or more active metal acts as anode and the metal with higher electrode potential acts as cathode.** The potential difference is main factor for corrosion to take place. The anodic metal undergoes corrosion whereas cathodic metal gets un -attacked.	2
		1
	Egs: When iron contact with copper, iron has lower electrode potential acts as anode.	
	At anode: $Fe \longrightarrow Fe^{2+} + 2e^-$	
	At cathode: $2H_2O + O_2 + 4e^- \longrightarrow 4OH^-$	
	$Fe^{2+} + 2OH \longrightarrow Fe(OH)_2$	
	$4Fe(OH)_2 + O_2 + 2H_2O \longrightarrow 2(Fe_2O_3 . 3H_2O)$	2
	Whereas copper which is having higher electrode potential acts as cathode gets unaffected. The rate of galvanic corrosion depends upon potential difference between anodic and cathodic metals, ratio of anodic and cathodic area and environmental factors and tendency of the metal to undergo passivity etc.	
1(b)	**Construct** Calomel electrode and **illustrate** working of electrode with reactions.	5
Sol		1
	Calomel electrode: The calomel electrode consists of a glass tube, Mercury is placed at the bottom of a glass tube. A paste of mercury and mercurous chloride is placed above the mercury. The space above the paste is filled with a KCl solution of known concentration. A platinum wire is kept immersed into the mercury to obtain electrical contact. Porous disc at the bottom of the outer tube acts as salt bridge. *Calomel electrode canbe represented as, Hg(l)| $Hg_2Cl_2(S)$,* KCl solution	1
	The Calomel electrode can act as anode or cathode depending on the nature of the other electrode of the cell.	
	Net half-cell reaction is $Hg_2Cl_2(s) + 2e^- \rightleftharpoons 2Hg(l) + 2Cl^-$	
	Electrode Potential (Nernst Equation for Calomel electrode) $E = E^0 - 0.0591 \log(Cl^-)$ *At 298 K*	2
	Hence, the electrode potential of Calomel electrode dependent on the concentration of chloride ions	
	Concentration of KCl | Saturated of Calomel Electrode | 0.242 V	1

1(c)	A thickness of alloy sheet of area 100 inch^2 is exposed to air near the ocean. After 1 year period it was found to experience a weight loss of 35 g due to corrosion. If the density of alloy is 8.4 g/cm^3. **Calculate** the CPR in mmpy and mpy.	
Sol	To calculate CPR in mmpy	

	Given	CPR in mmpy
K		87.6
W (wt loss)	35 g	35 x 1000 mg
ρ	8.4 g/ cm^3	8.4 g/ cm^3
A	100 inch^2	100 x 6.45cm^2
t	1 year	365 x 24 hrs

1 inch^2= 6.45 cm^2

1 cm^2 = 0.155 inch^2

$$CPR = \frac{k \times W}{D(\rho) \times A \times T} \qquad \frac{87.6 \times 35 \times 1000}{8.4 \times 100 \times 6.45 \times 365 \times 24}$$

CPR = **0.064 mmpy**

To calculate CPR in mpy

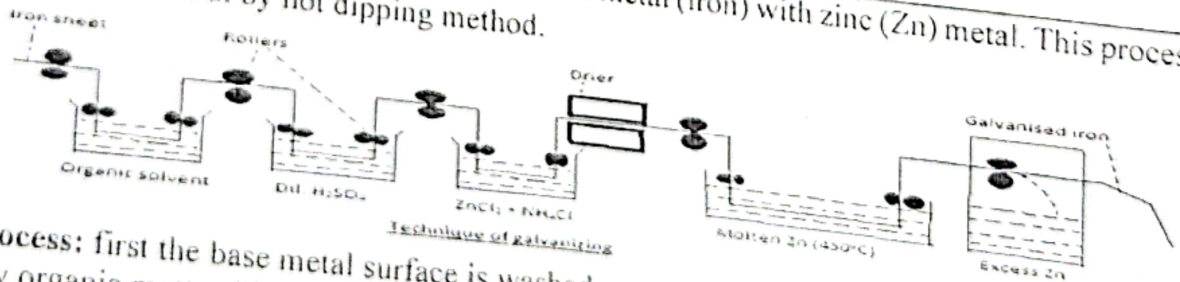
	Given	CPR in mpy
K		534
W (wt loss)	35 g	35 x 1000 mg
P	8.4 g/ cm^3	8.4 g/ cm^3
A	100 inch^2	100 inch^2
T	1 year	365 x 24 hrs

$$CPR = \frac{k \times W}{D(\rho) \times A \times T} \qquad \frac{534 \times 35 \times 1000}{8.4 \times 100 \times 365 \times 24}$$

CPR = **2.54 mpy**

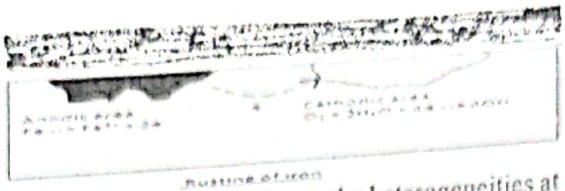
OR

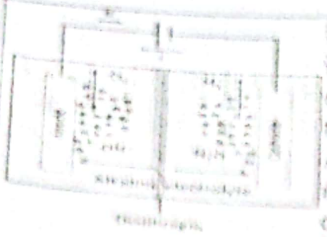
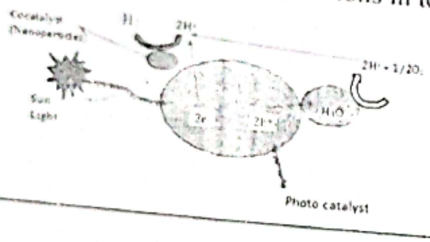
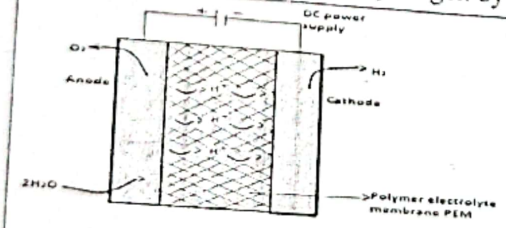
2(a)	What is galvanization? **Explain** corrosion control by galvanization process.	5
Sol	**Galvanisation:** It is a process of coating a base metal (iron) with zinc (Zn) metal. This process usually carried out by hot dipping method.	

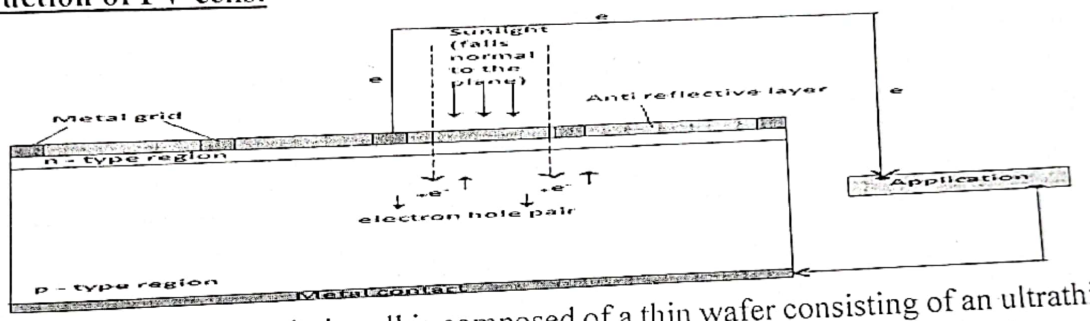


Process: first the base metal surface is washed properly with organic solvents to remove any organic matter (like oil, grease etc) on the surface afterwards it washed with dil. H_2SO_4 to remove any inorganic matter (like rust). Finally the base metal is well washed with water and air-dried. The base metal then dipped in a bath of molten zinc maintained at 425-450^{0}C and covered with a flux of NH_4Cl to prevent the oxidation of molten zinc. Then excess zinc on the surface is removed by passing through a pair of hot rollers so that a proper thin coating is obtained.

2(b)	**Applying** electrochemical theory of corrosion, **Illustrate** rusting of iron with reactions.	5

Sol	Most of the corrosion takes place on the basis of electrochemical reactions on the surface of metal such a type of corrosion is known as wet corrosion. When a metal like iron is exposed to the environment according to electrochemical theory corrosion of metal takes place due to the formation of anodic and cathodic regions on the same metal surface or when the two metals are in contact with each other in a corrosive medium.  These anodes and cathodes are formed due to the heterogeneities at the interfaces of the metal and environment. The heterogeneities on a metal surface could develop due to several factors like 1. On a metal surface if the concentration of the oxygen is different (if in the metal the area which is exposed to more oxygen acts as cathode, the area which is exposed to less oxygen concentration acts as anode). 2. Due to contact of two different metals (eg: if copper and iron are in contact with each other, then Fe acts as anode and copper acts as cathode due to change in electrode potential). 3. If metal surface subjected to stress (area under stress acts as anode). At anode oxidation takes place so that metal is converted into metal ions with the liberation of electrons. Eg: $Fe \longrightarrow Fe^{2+} + 2e^-$ **Cathodic reactions:** Cathodic reactions → Liberation of Hydrogen type → If the medium is acidic and in the absence of O_2: $2H^+ + 2e^- \longrightarrow H_2$ Liberation of Hydrogen type → If the medium is neutral or alkaline in the absence of O_2: $2H_2O + 2e^- \longrightarrow 2OH^- + H_2$ Cathodic reactions → Absorption of oxygen type → If the medium is acidic and in the presence of O_2: $4H^+ + O_2 + 4e^- \longrightarrow 2H_2O$ Absorption of oxygen type → If the medium is neutral or alkaline in the presence of O_2: $2H_2O + O_2 + 4e^- \longrightarrow 4OH^-$ The metal ions (Fe^{2+}) liberated at anode and some anions (OH^-) formed at cathode diffuse towards each other through the conducting medium and form a corrosion product somewhere between the anode and cathode as $Fe^{2+} + 2OH^- \longrightarrow Fe(OH)_2$ In an oxidizing environment, the insoluble $Fe(OH)_2$ oxidized to ferric oxide as following reaction. $4Fe(OH)_2 + O_2 + 2H_2O \longrightarrow 2(Fe_2O_3.3H_2O)$	1 1 2 1
2(c)	**Define** concentration cell. The emf of the cell $Cu(s)/CuSO_4(0.001M)//CuSO_4(XM)/Cu(s)$ is 0.0595V at 25°C, **Calculate** the value of X.	5
Sol	**Solution:** n= 2, C_2 = x M, C_1=0.0093 M $E_{cell} = \frac{0.0591}{n} \log \frac{C2}{C1}$, $0.0595 = \frac{0.0591}{2} \log \frac{X}{0.001}$ $\log \frac{X}{0.001} = 0.0595/0.0295$, $\log \frac{X}{0.001} = 2.016949$ $\frac{X}{0.001}$ = antilog 2.016949 $\frac{X}{0.001} = 103.9798$ **X= 0.1039 M**	2 1 1 1
	Part B	
3(a)	**Explain** the generation of hydrogen by alkaline water electrolysis.	5

	Sol	 Electrolysis of water is a non-spontaneous chemical reaction. It is carried out by applying sufficient voltage between the two electrodes in a electrolyser. The important components used in the electrolyser are as shown in the figure. **Anode:** Nickel metal particles dispersed on porous carbon is used as anode electrocatalyst. **Cathode:** Nickel metal particles coated on porous carbon is used as cathode electrocatalyst. **Electrolyte:** Aqueous solution of KOH (with 20 to 30 weight % KOH) is used as an electrolyte.**Separator:** Porous dense anion exchange membrane is used as the separator. It is a good ionic conductor of hydroxyl ions and bad electronic conductor. It prevents the spontaneous recombination of H_2 and O_2. **Working:** Deionized water is passed in to the cathode chamber. At cathode water molecules arereduced to hydrogen and hydroxyl ions. The hydroxyl ions move through the separator towards anode and get oxidized to oxygen and water. **Reactions:** At cathode: $2\,H_2O + 2\,e^- \rightarrow H_2\,(g) + 2\,OH^-$ At anode: $2\,OH^- \rightarrow \frac{1}{2}\,O_2\,(g) + H_2O + 2\,e^-$ Overall reaction: $H_2O + H_2\,(g) + \frac{1}{2}\,O_2\,(g)$	1 4(b) 2 2
3(b)	**Explain the production of Hydrogen by Photo catalytic water splitting method.**		5
	Sol	Splitting of water to get hydrogen by using photocatalyst and solar energy is called photocatalytic water splitting. When solar energy interacts the photocatalyst, produces charge carrier holes and electronsdue to absorption of energy. Thus, produced hole will react with the neighboring water molecule liberates the hydrogen ionand oxygen. Later electrons reduce the H^+ ions in to hydrogen gas.  **Reactions: -** $H_2O\,(l) + [hv] + 2h^+ \longrightarrow 2H^+\,(aq) + \frac{1}{2}\,O_2\,(g)$ $2H^+ + 2e^- \longrightarrow H_2\,(g)$	1 2 2
		OR	
4(a)	**Explain the production of Hydrogen by PEM water electrolysis.**		5
	Sol	 Electrolysis of water is a non-spontaneous chemical reaction. It is carried out by applying sufficient voltage between the two electrodes in an electrolyser. The important components used in the electrolyser are as shown in the figure. **Anode:** Iridium metal particles dispersed on porous carbon is used as anode electrocatalyst. **Cathode:** Platinum metal particles coated on porous carbon is used as cathode electrocatalyst. **Electrolyte/separator:** A porous solid polymer electrolyte made of chemically stable sulfonated tetrafluoroethylene base fluoro polymer (NAFION membrane) is used as an electrolyte as well as a separator. It is a good ionic conductor of protons and bad electronic conductor. It prevents the spontaneous recombination of H_2 and O_2. **Working:** Deionised water is passed in to the anode chamber, where it is oxidized liberating oxygen gas and hydrogen ions. The hydrogen ions migrate through the proton exchange electrolyte membrane towards cathode. At the cathode, the hydrogen ions are reduced to hydrogen gas. **Reactions:** At anode: $H2O \rightarrow \frac{1}{2}\,O2\,(g) + 2\,H^+ + 2\,e$ At cathode: $2\,H^+ + 2\,e \rightarrow + H2\,(g)$ Overall reaction: $H2O \rightarrow H2\,(g) + \frac{1}{2}\,O2\,(g)$	1 2 2

4(b)	**Explain** the construction, working and application of photovoltaic cell.	5
Sol	Photovoltaic cell is a device having semiconductor diodes converts the light energy (electromagnetic radiation) from solar or illumination source to electrical energy. It is also called as solar cells. So it will be generating electricity as long as it is exposed to light (i.e. sunlight).	1
	Construction of PV cells:	
		1
	• A typical silicon photovoltaic cell is composed of a thin wafer consisting of an ultrathin layer of phosphorous doped (n-type) silicon on top of boron doped (p-type) silicon. • Hence a p-n junction is formed between the two. • A metallic grid forms one of the electrical contacts of the diode and allows light to fall on the semiconductor between the grid lines. • An antireflective layer between the grid lines increase the amount of light transmitted to the semiconductor. • The cell's other electrical contact is formed by a metallic layer on the back of the solar cell.	2
	Working: • When light radiation falls on the p-n junction diode, electron-hole pairs are generated by the absorption of the radiation • The electrons are drifted to and collected at the n- type end and the holes are drifted to and collected at the p-type end. • When these two ends are electrically connected through a conductor, there is a flow of current between the two ends through the external circuit. Thus photoelectric current is produced and available for use.	1

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

DEPARTMENT OF APPLIED SCIENCE
SESSION: 2023-2024 (EVEN SEMESTER)
I SESSIONAL TEST QUESTION PAPER
SET-B

Degree	:	B.E	USN			
Branch	:	CSE & AIDS	Semester	:	II	
Course Title	:	Applied Chemistry	Course Code	:	BCHES202	
Duration	:	60 Minutes	Date	:	22/4/2024	
			Max Marks	:	25	

Note: Answer ONE full question from each part.

Q No.	Question	Marks	K-Level	CO mapping
	PART-A			
1(a)	**Derive** an expression for pH using Glass electrode	5	Applying K3	CO1
(b)	**Applying** electrochemical theory of corrosion, **Illustrate** rusting of iron with reactions.	5	Applying K3	CO1
(c)	**Define** concentration cell? The emf of the cell $Cu(s)/CuSO_4(0.001M)//CuSO_4(XM)/Cu(s)$ is 0.0595V at 25°C, **Calculate** the value of X.	5	Applying K3	CO1
	OR			
2(a)	**Illustrate** corrosion control in Iron by **applying** galvanization technique.	5	Applying K3	CO1
(b)	**Construct** Calomel electrode and **illustrate** working of electrode with reactions.	5	Applying K3	CO1
(c)	A thickness of alloy sheet of area 100 $inch^2$ is exposed to air near the ocean. After 1 year period it was found to experience a weight loss of 35 g due to corrosion. If the density of alloy is 8.4 g/cm^3. **Calculate** the CPR in mmpy and mpy.	5	Applying K3	CO1
	PART-B			
3(a)	**Explain** the production of Hydrogen by PEM water electrolysis.	5	Understanding K2	CO2
(b)	**Explain** the construction and working of photovoltaic cells.	5	Understanding K2	CO2
	OR			
4(a)	**Explain** the generation of hydrogen by alkaline water electrolysis.	5	Understanding K2	CO2
(b)	**Explain** the production of Hydrogen by Photo catalytic water splitting method.	5	Understanding K2	CO2

Course Incharge

HOD-AS
Dr. C. VASUDEV

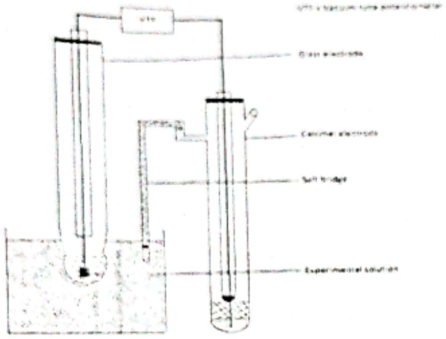
IQAC- Coordinator

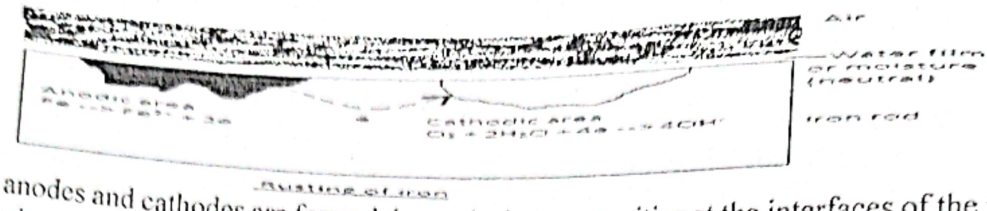
Principal
Dr. K. RAMA NARASIM
Principal/Director

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT,
BENGALURU-560109
DEPARTMENT OF APPLIED SCIENCE
SESSION: 2023-2024 (EVEN SEMESTER)
SCHEME OF I SESSIONAL TEST QUESTION PAPER
SET- B

Degree	:	B.E	Semester	:	II
Branch	:	CSE & AIDS	Date	:	22-04-2024
Course Title	:	Applied Chemistry	Course Code	:	BCHES202
Duration	:	60 Minutes	Max Marks	:	25

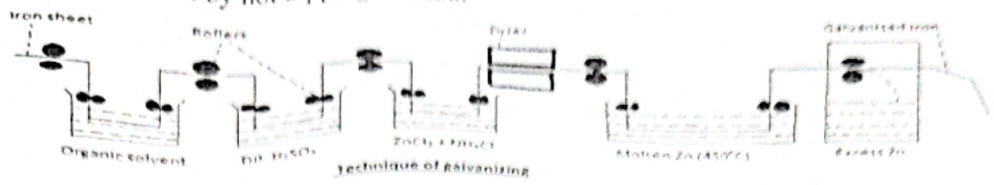
Note: Answer ONE full question from each part

Q. No.	Questions with Scheme & Solution	Marks
	PART-A	
1(a)	Derive an expression for pH using Glass electrode	5
Sol	***Principle:*** When a thin glass membrane is placed between two solutions of different pH values, a potential difference arises across the membrane. The potential difference varies as the pH of these solutions varies. In practice, pH of one of these solutions is kept constant and therefore the electrode potential depends on pH of the other solution ie experimental solution.	2
	 ***Procedure:*** glass electrode is immersed in the solution; the pH is to be determined. It is combined with a reference electrode such as a calomel electrode through a salt bridge. The cell assembly is represented as, Hg| Hg_2Cl_2|Cl^-||Solution of unknown pH|glass|0.1M HCl|AgCl|Ag The emf of the above cell, Ecell is measured using an electronic voltmeter with a pH meter. The emf of the cell is given by	1
	$E_{Cell} = E_{Cathode} - E_{Anode}$ ....1 Since E SCE is knowing emf the cell, $E_{Cell} = E_{Glass} - E_{SCE}$ .... 2 **E glass can be evaluated.**	
	The potential of glass electrode is given by $E_{Glass} = E_1 - E_2$.....3 Where, E_1 & E_2 are the electrode potential of outer & inner membrane $E_{Glass} = [E^O + 0.0591 \log (C_1)] - [E^O + 0.0591 \log(C_2)]$ *Where* C_1 & C_2 *are the concentrations of outer & inner acid solutions.* $E_{Glass} = 0.0591 \log(C_1) - 0.0591 \log(C_2)$ $E_{Glass} = -0.0591 \log(C_2) + 0.0591 \log(C_1)$	1
	Since the H^+ concentration inside the glass bulb is a constant. The first term on RHS of the above equation becomes a constant. $E_{Glass} = Cons\tan t + 0.0591 .\log[C_1]$ $E_{Glass} = Cons\tan t + 0.0591 .\log[H^+]$ Since, $C_1 = [H^+]$ $E_{Glass} = Cons\tan t - 0.0591 .pH$ .....4 Where $P^H = -\log [H^+]$	
	Substitute the equation 4 in equation 2. $E_{cell} = Cons\tan t - 0.0591 .pH - E_{SCE}$ $pH = \frac{Cons\tan t - E_{cell} - E_{SCE}}{0.0591}$	1
1(b)	Applying electrochemical theory of corrosion, **Illustrate** rusting of iron with reactions.	5

Sol	Most of the corrosion takes place on the basis of electrochemical reactions on the surface of metal such a type of corrosion is known as wet corrosion. When a metal like iron is exposed to the environment according to electrochemical theory corrosion of metal takes place due to the formation of anodic and cathodic regions on the same metal surface or when the two metals are in contact with each other in a corrosive medium.	1
		
	These anodes and cathodes are formed due to the heterogeneities at the interfaces of the metal and environment. The heterogeneities on a metal surface could develop due to several factors like 1. On a metal surface if the concentration of the oxygen is different (if in the metal the area which is exposed to more oxygen acts as cathode, the area which is exposed to less oxygen concentration acts as anode). 2. Due to contact of two different metals (eg: if copper and iron are in contact with each other, then Fe acts as anode and copper acts as cathode due to change in electrode potential). 3. If metal surface subjected to stress (area under stress acts as anode). At anode oxidation takes place so that metal is converted into metal ions with the liberation of electrons. Eg: Fe $\rightarrow Fe^{2+} + 2e^-$	1
	Cathodic reactions: Cathodic reactions → Liberation of Hydrogen type → If the medium is acidic and in the absence of O_2: $2H^+ + 2e^- \rightarrow H_2$ Cathodic reactions → Liberation of Hydrogen type → If the medium is neutral or alkaline in the absence of O_2: $2H_2O + 2e^- \rightarrow 2OH^- + H_2$ Cathodic reactions → Absorption of oxygen type → If the medium is acidic and in the presence of O_2: $4H^+ + O_2 + 4e^- \rightarrow 2H_2O$ Cathodic reactions → Absorption of oxygen type → If the medium is neutral or alkaline in the presence of O_2: $2H_2O + O_2 + 4e^- \rightarrow 4OH^-$	2
	The metal ions (Fe^{2+}) liberated at anode and some anions (OH^-) formed at cathode diffuse towards each other through the conducting medium and form a corrosion product somewhere between the anode and cathode as $Fe^{2+} + 2OH^- \rightarrow Fe(OH)_2$ In an oxidizing environment, the insoluble $Fe(OH)_2$ oxidized to ferric oxide as following reaction. $4Fe(OH)_2 + O_2 + 2H_2O \rightarrow 2(Fe_2O_3.3H_2O)$	1
1(c)	**Define** concentration cell? The emf of the cell $Cu(s)/CuSO_4(0.001M)//CuSO_4(XM)/Cu(s)$ is 0.0595V at 25°C, **Calculate** the value of X.	
Sol	**Solution:** n= 2, C_2 = x M, C_1=0.0093 M $E_{cell} = \frac{0.0591}{n} \log \frac{C2}{C1}$, $0.0595 = \frac{0.0591}{2} \log \frac{X}{0.001}$	2
	$\log \frac{X}{0.001} = 0.0595/0.0295$, $\log \frac{X}{0.001} = 2.016949$	1
	$\frac{X}{0.001}$ = antilog 2.016949 $\frac{X}{0.001} = 103.9798$ **X= 0.1039 M**	1
	OR	1
2(a)	**Illustrate** corrosion control in Iron by **applying** galvanization technique.	5

Sol

Galvanisation: It is a process of coating a base metal (iron) with zinc (Zn) metal. This process usually carried out by hot dipping method. — 1



2

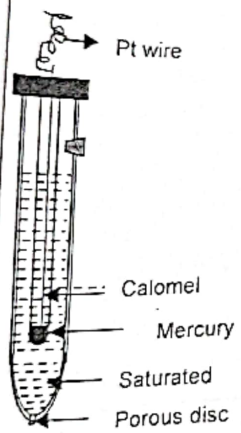
Process: first the base metal surface is washed properly with organic solvents to remove any organic matter (like oil, grease etc) on the surface afterwards it washed with dil. H_2SO_4 to remove any inorganic matter (like rust). The base metal is well washed with water and air-dried. The base metal then dipped in a bath of molten zinc maintained at 425-450^{0}C and covered with a flux of NH_4Cl to prevent the oxidation of molten zinc. Then excess zinc on the surface is removed by passing through a pair of hot rollers so that a proper thin coating is obtained. — 2

2(b) **Construct** Calomel electrode and **illustrate** working of electrode with reactions. — 5

Sol

Calomel electrode: — 1

The calomel electrode consists of a glass tube, Mercury is placed at the bottom of a glass tube. A paste of mercury and mercurous chloride is placed above the mercury. The space above the paste is filled with a KCl solution of known concentration. A platinum wire is kept immersed into the mercury to obtain electrical contact. Porous disc at the bottom of the outer tube acts as salt bridge.



Calomel electrode canbe represented as, Hg(l)| Hg_2Cl_2(S), KCl solution — 1

The Calomel electrode can act as anode or cathode depending on the nature of the other electrode of the cell.

Net half-cell reaction is — 2

$$Hg_2Cl_2(s) + 2e^- \rightleftharpoons 2Hg(l) + 2Cl^-$$

Electrode Potential $E = E^0 - 0.0591 \log(Cl^-)$ *At* 298 *K*

(Nernst Equatation for Calomel electrode)

Hence, the electrode potential of Calomel electrode dependent on the concentration of chloride ions

Concentration of KCl	Saturated
Potential of Calomel Electrode	0.242 V

— 1

2(c) A thickness of alloy sheet of area 100 inch^2 is exposed to air near the ocean. After 1 year period it was found to experience a weight loss of 35 g due to corrosion. If the density of alloy is 8.4 g/cm^3. **Calculate** the CPR in mmpy and mpy. — 5

Sol

To calculate CPR in mmpy — ½

	Given	CPR in mmpy
		87.6
K		35 x 1000 mg
W (wt loss)	35 g	8.4 g/ cm^3
ρ	8.4 g/ cm^3	100 x 6.45cm^2
A	100 inch^2	365 x 24 hrs
t	1 year	

1 inch^2= 6.45 cm^2

1 cm^2 = 0.155 inch^2

$$CPR = \frac{k \times W}{D(\rho) \times A \times T} \qquad \frac{87.6 \times 35 \times 1000}{8.4 \times 100 \times 6.45 \times 365 \times 24}$$ — 2

CPR = 0.064 mmpy

To calculate CPR in mpy

	Given	CPR in mpy
K		534
W (wt loss)	35 g	35 x 1000 mg
P	8.4 g/ cm^3	8.4 g/ cm^3
A	100 inch^2	100 inch^2
T	1 year	365 x 24 hrs

CPR = 2.54 mpy

$$CPR = \frac{k \times W}{D(\rho) \times A \times T} \qquad \frac{534 \times 35 \times 1000}{8.4 \times 100 \times 365 \times 24}$$

½

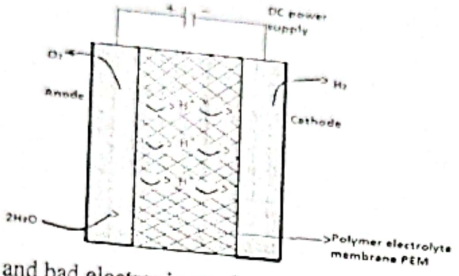
2

Part B

3(a) **Explain the production of Hydrogen by PEM water electrolysis.** 5

Sol

Electrolysis of water is a non-spontaneous chemical reaction. It is carried out by applying sufficient voltage between the two electrodes in an electrolyser. The important components used in the electrolyser are as shown in the figure. 1



Anode: Iridium metal particles dispersed on porous carbon is used as anode electrocatalyst.
Cathode: Platinum metal particles coated on porous carbon is used as cathode electrocatalyst.
Electrolyte/separator: A porous solid polymer electrolyte made of chemically stable sulfonated tetrafluoroethylene base fluoro polymer (NAFION membrane) is used as an electrolyte as well as a separator. It is a good ionic conductor of protons and bad electronic conductor. It prevents the spontaneous recombination of H2 and O2. 2

Working: Deionised water is passed in to the anode chamber, where it is oxidized liberating oxygen gas and hydrogen ions. The hydrogen ions migrate through the proton exchange electrolyte membrane towards cathode. At the cathode, the hydrogen ions are reduced to hydrogen gas.

Reactions: At anode: $H2O \rightarrow ½\ O2\ (g) + 2\ H^+ + 2\ e$ 2

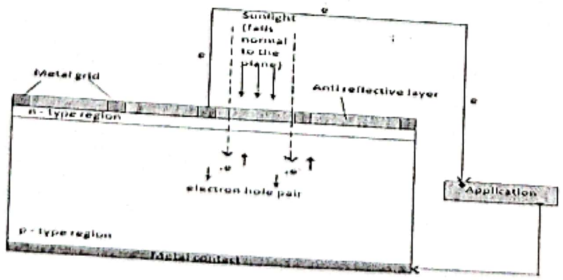
At cathode: $2\ H^+ + 2\ e \rightarrow + H2\ (g)$

Overall reaction: $H2O + H2\ (g) + ½\ O2\ (g)$

3(b) **Explain the construction and working of photovoltaic cells.** 5

Sol

Photovoltaic cell is a device having semiconductor diodes converts the light energy (electromagnetic radiation) from solar or illumination source to electrical energy. It is also called as solar cells. So it will be generating electricity as long as it is exposed to light (i.e. sunlight). 1



Construction of PV cells:

- A typical silicon photovoltaic cell is composed of a thin wafer consisting of an ultrathin layer of phosphorous doped (n-type) silicon on top of boron doped (p-type) silicon. 1
- Hence a p-n junction is formed between the two.
- A metallic grid forms one of the electrical contacts of the diode and allows light to fall on the semiconductor between the grid lines.
- An antireflective layer between the grid lines increase the amount of light transmitted to the semiconductor.
- The cell's other electrical contact is formed by a metallic layer on the back of the solar cell. 2

Working:

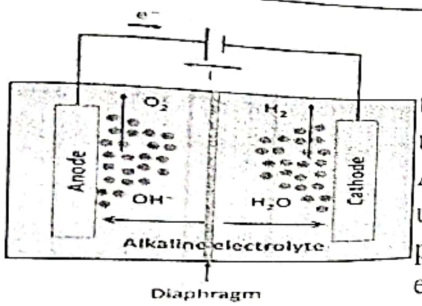
- When light radiation falls on the p-n junction diode, electron-hole pairs are generated by the absorption of the radiation
- The electrons are drifted to and collected at the n-end and the holes are drifted to and collected at the p-type end.

When these two ends are electrically connected through a conductor, there is a flow of current between the two ends through the external circuit. — 1

OR — 5

4(a) **Explain** the generation of hydrogen by alkaline water electrolysis. — 1

Sol



Electrolysis of water is a non-spontaneous chemical reaction. It is carried out by applying sufficient voltage between the two electrodes in a electrolyser. The important components used in the electrolyser are as shown in the figure.

Anode: Nickel metal particles dispersed on porous carbon is used as anode electrocatalyst. Cathode: Nickel metal particles coated on porous carbon is used as cathode electrocatalyst.

Electrolyte: Aqueous solution of KOH (with 20 to 30 weight % KOH) is used as an electrolyte.

Separator: Porous dense anion exchange membrane is used as the separator. It is a good ionic conductor of hydroxyl ions and bad electronic conductor. It prevents the spontaneous recombination of H2 and O2. — 1

Working: Deionized water is passed in to the cathode chamber. At cathode water molecules arereduced to hydrogen and hydroxyl ions. The hydroxyl ions move through the separator towards anode and get oxidized to oxygen and water. — 2

Reactions: At cathode: $2\ H_2O + 2\ e^- \rightarrow\ H_2\ (g) + 2\ OH^-$

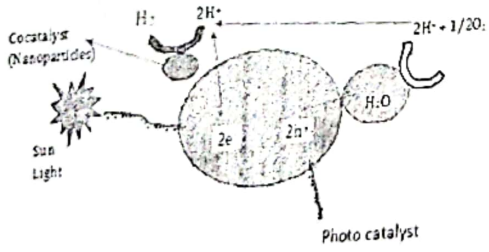
At anode: $2\ OH^- \rightarrow ½\ O2\ (g) + H_2O + 2\ e^-$

Overall reaction: $H_2O \rightarrow\ H_2\ (g) + ½\ O_2\ (g)$ — 2

4(b) **Explain** the production of Hydrogen by Photo catalytic water splitting method. — 5

Sol

Splitting of water to get hydrogen by using photocatalyst and solar energy is called photocatalytic water splitting. — 1



When solar energy interacts the photocatalyst, produces charge carrier holes and electrons due to absorption of energy.

Thus, produced hole will react with the neighboring water molecule liberates the hydrogen ion and oxygen. — 2

Later electrons reduce the H^+ ions in to hydrogen gas.

Reactions: -

$H_2O\ (l) + [h\nu] + 2h^+ \longrightarrow 2H^+\ (aq) + ½\ O_2\ (g)$

$2H^+ + 2e^- \longrightarrow H2\ (g)$ — 2

Head of the Department 15/04/2024

Principal

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE -560109

DEPARTMENT OF APPLIED SCIENCE

SESSION: 2023-2024 (EVEN SEMESTER)

II SESSIONAL TEST QUESTION PAPER

SET-A

Degree	:	B.E	USN		
Branch	:	CSE & AI-DS	Semester	:	II
Course Title	:	Applied Chemistry for CSE Stream	Course Code	:	BCHES202
Duration	:	75 Minutes	Date	:	29/5/2024
			Max Marks	:	25

Note: Answer ONE full question from each part.

Q No.	Question	Marks	K-Level	CO mapping
	PART-A			
	In a sample of a polymer, 100 molecules have molecular mass 10^3g/mol, 250 molecules have molecular mass 10^4g/mol, and 300 molecules have molecular mass10^5g/mol, **Calculate** the number average, weight average molecular mass of the polymer and **Find** PDI and comment on it.	5	Applying K3	CO2
(b)	**Explain** the preparation, properties, and commercial applications of Kevlar Fiber	5	Understanding K2	CO2
	OR			
2(a)	In a sample of a polymer, 20% molecules have molecular mass 15000 g/mol,35% molecules have molecular mass 25000 g/mol, and remaining molecules have molecular mass 20000 g /mol, **Calculate** the number average and weight average molecular mass of the polymer and **Find** PDI, comment on it.	5	Applying K3	CO2
(b)	**Describe** the conduction mechanism in Polyacetylene through oxidative or reductive doping technique.	5	Understanding K2	CO2
	PART-B			
	Using gas sensors **Illustrate** the working principle of electrochemical gas sensors for the detection of SOx and NOx	5	Applying K3	CO3
(b)	**Explain** Na-Ion battery construction, it's working and applications	5	Understanding K2	CO3
(c)	**What** are disposable sensors? **Mention** the advantages of disposable sensors.	5	Understanding K2	CO3
	OR			
4(a)	**Using** Electrochemical Sensors, **Illustrate** measurement of Dissolved Oxygen (DO)	5	Applying K3	CO3
(b)	**Explain** the construction, working and uses of Li-Ion battery.	5	Understanding K2	CO3
(c)	**Discuss** the detection of a ascorbic acid bio-molecule using disposable sensor also **write** the electro oxidation reaction.	5	Understanding K2	CO3

Course Incharge

HOD

Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management
Bangalore - 560 109

IQAC- Coordinator

Principal

Dr. K. RAMA NARASIMHA
Principal/Director
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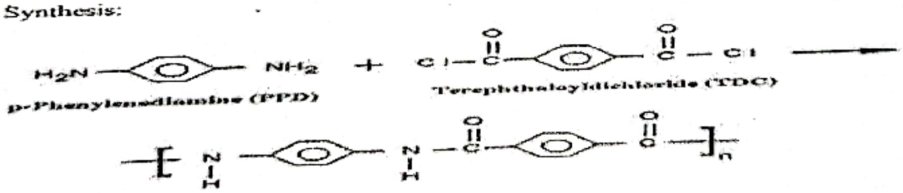
Q. No.	Questions with Scheme & Solution	Marks
	PART-A	
1(a)	In a sample of a polymer, 100 molecules have molecular mass 10^3g/mol, 250 molecules have molecular mass 10^4g/mol, and 300 molecules have molecular mass10^5g/mol, **Calculate** the number average, weight average molecular mass of the polymer and **Find** PDI and comment on it.	5
ol	**Solution** It is given that, N_1 =100 & M_1 = 10^3g/mol, N_2 =250 & M_1 = 10^4 g/mol, N_3 =300 & M_1 = 10^5 g/mol, The number average molecular mass of the polymer is given by $\overline{Mn} = \frac{\sum NiMi}{\sum Ni}$ $= \frac{N_1M_1 + N_2M_2 + N_3M_3}{N1+N2+N3\ldots} = \frac{100X10^3 + 250X10^4 + 300X10^5}{100+250+300} = 50153 g/mol$ The weight average molecular mass of the polymer is given by $\overline{Mw} = \frac{\sum NiMi^2}{\sum NiMi}$ $\overline{M_w} = \frac{N_1M_1^2 + N_2M_2^2 + N_3M_3^2}{N_1M_1 + N_2M_2 + N_3M_3}$ $\overline{M_w} = \frac{100X(10^3)^2 + 250X(10^4)^2 + 300X(10^5)^2}{100X10^3 + 250X10^4 + 300X10^5} = 92794\ g/mol$ Poly dispersity index, PDI = $\frac{\overline{Mw}}{\overline{Mn}} = \frac{92794}{50100} = 1.85$ PDI >1, the given polymer is less homogeneous and poly disperse in nature.	1 1 1 1 1 1
(b)	**Explain** the preparation, properties, and commercial applications of Kevlar Fiber.	5
ol	Kevlar is a polyamide, in which all the amide groups are separated by para-phenylene groups. The Chemical composition of Kevlar is poly para phenylene terephthalamide Synthesis:  Kevlar is fiber embedded in an epoxy resin polymer matrix is called Polymer Composite.	1
ol	**Properties of Kevlar** 1. Kevlar is crystalline, lightweight and non-flammable 2. Resistant to heat, impact, scratch 3. Withstands harsh environmental conditions 4. Abrasion and corrosion resistant 5. High tensile strength 6. Resistant to Chemicals	2 1
	Applications 1. It is used in lightweight boat hulls. Aircraft panels, Racecars 2. Bulletproof vests and combat helmets 3. Reinforce material for car tires, bicycle tires, which reduces puncture rate	

3. Reinforce material for car tires, bicycle tires, which reduces puncture rate
4. Marine current turbine and wind turbine
5. Ropes and cables
6. Fiber-optic cables for communication, data transmission and ignition

OR

2(a) In a sample of a polymer, 20% molecules have molecular mass 15000 g/mol,35% molecules have molecular mass 25000 g/mol, and remaining molecules have molecular mass 20000 g /mol, **Calculate** the number average and weight average molecular mass of the polymer and **Find** PDI, comment on it.

Sol

Solution

It is given that,

$N_1 = 20$ & $M_1 = 15000$g/mol.

$N_2 = 35$ & $M_2 = 25000$g/mol.

$N_3 = 45$ & $M_3 = 20000$ g/mol.

The number average molecular mass of the polymer is given by

$$\overline{Mn} = \frac{\sum NiMi}{\sum Ni} = \frac{N_1M_1 + N_2M_2 + N_3M_3}{N1 + N2 + N3\ldots}$$

$$= \frac{20X15000 + 35X25000 + 45X20000}{20+35+45} = 20750\ g/mol$$

The weight average molecular mass of the polymer is given by

$$\overline{Mw} = \frac{\sum Ni\,Mi^2}{\sum Ni\,Mi}$$

$$\overline{M_w} = \frac{N_1M_1^2 + N_2M_2^2 + N_3M_3^2}{N_1M_1 + N_2M_2 + N_3M_3}$$

$$\overline{M_w} = \frac{20X(15000)^2 + 35X(25000)^2 + 45X(20000)^2}{20X15000 + 35X25000 + 45X20000} = 21385\,g/mol$$

Poly dispersity index, $PDI = \frac{\overline{Mw}}{\overline{Mn}} = \frac{21385}{20750} = 1.03$

PDI >1 ,the given polymer is less homogeneous and poly disperse in nature.

2(b) **Describe** the conduction mechanism in Polyacetylene through oxidative or reductive doping technique

Sol

Mechanism of conduction in polyacetylene: Conducting polymers are generally produced by doping an oxidizing or a reducing agent into an organic polymer with conjugated back bone consisting of pi-electron system.

An organic polymer can be converted into a conducting polymer if it has

1. Linear structure
2. Extensive conjugation in polymeric back bone (Pi-back bone)

The conducting polymers are synthesized by doping, in which charged species are introduced in organic polymers having pi-back bone. The important doping reactions are;

1. Oxidative doping (p-doping)
2. Reductive doping (n-doping)

1. Oxidative doping (p-doping): In this process, pi-back bone of a polymer is partially oxidized using a suitable oxidizing agent. This creates positively charged sites on polymer back bone, which are current carriers for conduction.

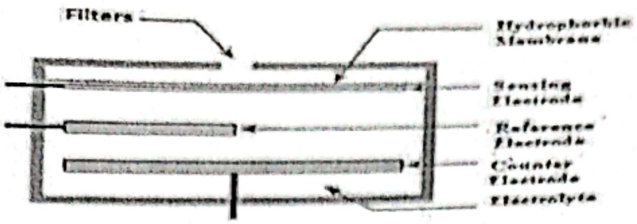
The oxidizing agents used in p-doping are iodine vapor, iodine in CCl4, HBF4, perchloric acid and benzoquinone.

2

PART-B

3(a) **Using** gas sensors **Illustrate** the working principle of electrochemical gas sensors for the detection of SOx and NOx 5

Electrochemical gas sensors for SOx and NOx.



Filters: Used to prevent unwanted contaminants, mainly particulate matter
Membrane: A gas-permeable membrane is used to regulate the gas flow into the sensors. It allows only analyte gas to pass and prevent the leakage of the electrolyte.
Electrodes: two or three electrodes are used on the requirement. Working or sensing, counter and reference electrode.
Electrolyte: Electrolyte should be ionic conductor and chemically stable. Main role is , it transport charge within the sensor, contact all electrodes effectively and solubilise the reactant and product for efficient transport.

Sensors for SOX:
The sensors contains two or three electrodes
Sensing electrode: Au/Nafion
Electrolyte: 0.5M H2SO4

Working:
- The diffusion of gas analyte through filter, membrane and then finally through electrolyte on to the surface of sensing electrode.
- Adsorption of analyte gas molecules on the surface of sensing electrode.
- Oxidation of analyte on the surface of sensing electrode, liberating electrons.
- Desorption of product from the electrode surface.
- Diffusion of the products away from the reaction zone to bulk of electrolyte.

$$SO_2 + 2H_2O \rightarrow SO_4^{2-} + 4H^+ + 2e^-$$

Sensors for NO2:
The sensors contain two or three electrodes.
Sensing electrode: Au, Pt/Nafion.
Electrolyte: 10 M H2SO4

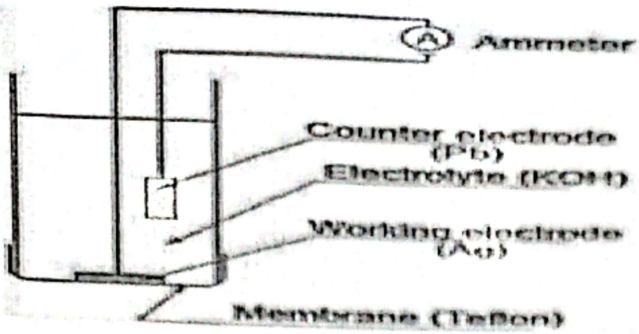
Working:
- The diffusion of gas analyte through filter, membrane and then finally through electrolyte on to the surface of sensing electrode.
- Adsorption of analyte gas molecules on the surface of sensing electrode.
- Oxidation of analyte on the surface of sensing electrode, liberating electrons.
- Desorption of product from the electrode surface.
- Diffusion of the products away from the reaction zone to bulk of electrolyte.

$$NO_2 + 2H^+ + 2e^- \rightarrow NO + 2H_2O$$

Sensors for NO:
The sensors contain two or three electrodes.
Sensing electrode: Au/NASICON.
Electrolyte: NaNO2
Working:
- *The diffusion of gas analyte through filter, membrane and then finally through electrolyte on to the surface of sensing electrode.*
- *Adsorption of analyte gas molecules on the surface of sensing electrode.*
- *Oxidation of analyte on the surface of sensing electrode, liberating electrons.*
- *Desorption of product from the electrode surface.*
- *Diffusion of the products away from the reaction zone to bulk of electrolyte.*

$$NO + 2H_2O \rightarrow NO_3^{2-} + 4H^+ + 3e^-$$

3(b)	**Explain** Na-Ion battery construction, it's working and applications	5
	SODIUM-ION BATTERY (SIB) Composition of the battery: Reactive species at anode : Carbon Reactive species at cathode : NaCoO2	2



2

Working:

The difference in potential between the anode and the cathode should be at least 0.5V.
When electrode is dipped in water to measure DO, anode undergoes oxidation liberating electrons

$$2Zn \rightarrow 2Zn^{2+}4e^-$$

At cathode, DO undergo reduction. Ag cathode is inert, it only passes electrons to oxygen for reduction.

Overall reaction is

$$O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$$

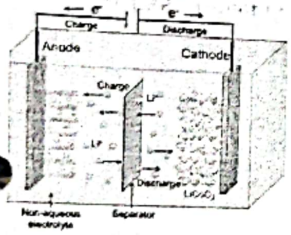
$$2Zn + O_2 + 2H_2O \rightarrow 2Zn(OH)_2$$

The current produced by the reduction of oxygen at cathode is proportional to the oxygen in the water sample.

b) **Explain** the construction, working and uses of Li-Ion battery. 5

Composition of the battery:

Reactive species at anode : graphite 2
Reactive species at cathode : LiCoO2
Electrolyte : Lithium salt
Separator : Polypropylene
Output Voltage : 3.6V



Working of LIB:

During charging lithium ions in cathodic side (positive electrode) is migrated and move towards anodic side (negative electrode)

$$Cathodic\ Reaction: LiCoO_2 \rightarrow Li_{(1-x)}CoO_2 + xLi^+ + xe^-$$
$$Anodic\ Reaction: xLi^+ + xe^- + 6C \rightarrow xLiC_6$$
$$Overall\ Reaction: LiCoO_2 + 6C \leftrightarrow Li_{(1-x)}CoO_2 + xLiC_6$$

2

During discharging lithium ions move from anode to cathode.

$$Anodic\ Reaction: xLiC_6 \rightarrow xLi^+ + xe^- + 6C$$
$$Cathodic\ Reaction: Li_{(1-x)}CoO_2 + xLi^+ + xe^- \rightarrow LiCoO_2$$
$$Overall\ Reaction: Li_{(1-x)}CoO_2 + xLiC_6 \rightarrow LiCoO_2 + 6C$$

Applications of LIB:

The Li - ion batteries are used in mobile phones, cameras, calculators, LCD TVs, pagers, to operate laptop computers, in aerospace applications. 1

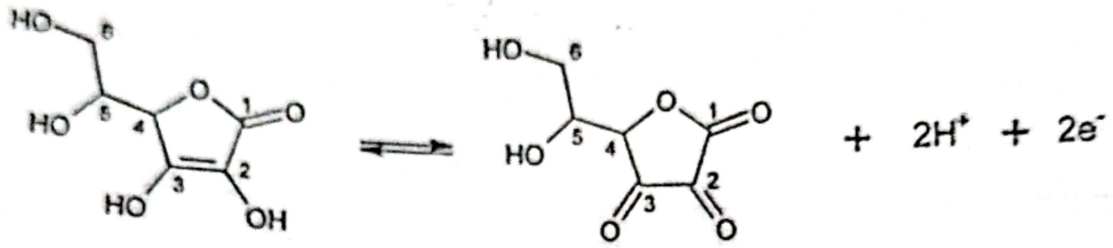
4(c) **Discuss** the detection of a ascorbic acid bio-molecule using disposable sensor also **write** the electr... oxidation reaction.

Sol

Detection of Ascorbic acid.

Ascorbic acid is a chemical name of Vitamin-C, it is water soluble. In the disposable strip, the sensing electrode, counter and reference electrode are printed using Screen printing technology.

Working: Active material is coated on sensing electrode must be capable of oxidizing ascorbic acid on its surface. The active surfaces of the counter electrode and working electrode have been coated with aconductive ink of C (MWCNT) and modified with gold nanoparticles. Reference electrode is Ag/AgCl The sensor is immersed in the analyte. The analyte diffuses and adsorbed on the sensing electrode.The sensing electrode oxidizes ascorbic acid into dehydroascorbic acid and produces electric current or voltage and it is proportional to the concentration of the ascorbic acid.



Ascorbic acid

Dehydroascorbic acid

Course In charge

Head of the Department

Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management
Bangalore - 560 109

Principal
Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Management
Bengaluru - 560 109

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II SESSIONAL TEST QUESTION PAPER

SET-B

190

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Course Title	:	Applied Chemistry for CSE Stream	Course Code	:	BCHES202
Duration	:	75 Minutes	Date	:	29/5/2024
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	Question	Marks	K-Level	CO mapping
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	Describe the conduction mechanism in Polyacetylene through oxidative or reductive doping technique	5	Understanding K2	CO2
	OR			
	In a sample of a polymer, 100 molecules have molecular mass 10^3g/mol, 250 molecules have molecular mass 10^4g/mol, and 300 molecules have molecular mass 10^5g /mol, **Calculate** the number average and weight average molecular mass of the polymer, **Calculate** PDI and comment on it.	5	Applying K3	CO2
	Explain the preparation, properties, and commercial applications of Kevlar fibre.	5	Understanding K2	CO2
	PART-B			
	Explain the principle, working and applications of conductometric sensors	5	Understanding K2	CO3
	Illustrate the construction, working and applications of Lithium-ion batteries	5	Applying K3	CO3
	What are Quantum Dot Sensitized Solar Cells (QDSSC's)? **Explain** the working Principle, Properties and Applications.	5	Understanding K2	CO3
	OR			
	Explain the working principle of electrochemical gas sensors for detection of SOx and NOx	5	Understanding K2	CO3
	Illustrate the construction, working and uses of Na-Ion battery.	5	Applying K3	CO3
	What are disposable sensors? **Mention** the advantages of disposable sensors.	5	Understanding K2	CO3

Course Incharge

HOD 16/5/24
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Professor & HOD
Department of Applied Science

IQAC- Coordinator

Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Manage
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SET-B

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Course Title : Applied Chemistry for CSE Stream
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Q. No.	Questions with Scheme & Solution	Marks
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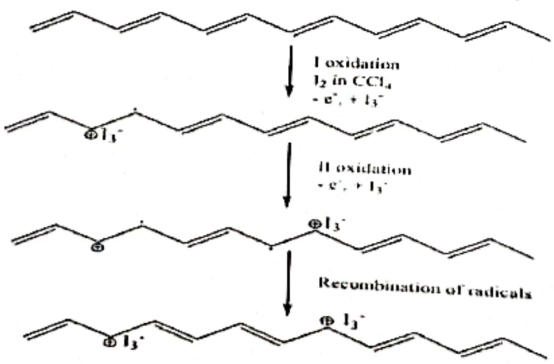
Sol	N_1 =20 & M_1 = 15000g/mol, N_2 =35 & M_1 = 25000g/mol, N_3 =45 & M_1 = 20000 g/mol. The number average molecular mass of the polymer is given by $\overline{Mn} = \frac{\sum NiMi}{\sum Ni} = \frac{N_1M_1 + N_2M_2 + N_3M_3}{N1+N2+N3...}$	1
	$= \frac{20X15000+35X25000+45X20000}{20+35+45} = 20750\,g/mol$	1
	The weight average molecular mass of the polymer is given by $\overline{Mw} = \frac{\sum Ni\,Mi^2}{\sum Ni\,Mi}$	
	$\overline{M_w} = \frac{N_1M_1^2 + N_2M_2^2 + N_3M_3^2}{N_1M_1 + N_2M_2 + N_3M_3}$	1
	$\overline{M_w} = \frac{20X(15000)^2 + 35X(25000)^2 + 45X(20000)^2}{20X15000+35X25000+45X20000} = 21385g/mol$	
	Poly dispersity index, PDI $= \frac{\overline{Mw}}{\overline{Mn}} = \frac{21385}{20750} = 1.03$	1
	PDI >1 ,the given polymer is less homogeneous	1
1(b)	**Describe** the conduction mechanism in Polyacetylene through oxidative or reductive doping technique.	5
Sol	**1. Oxidative doping (p-doping):** In this process, an appropriate oxidizing agent is added to bring partial oxidation of polymer pi-backbone. Thus, positively charged sites are generated on the polymer backbone and facilitates the movement of charge carriers in the chain. Most commonly used oxidative doping or p-doping agents are iodine vapor, iodine in CCl_4, HBF_4, perchloric acid and benzoquinone.	1
	 Reactions of p- doping of polyacetylene	1 1 1 1

2. Reductive doping (n-doping):

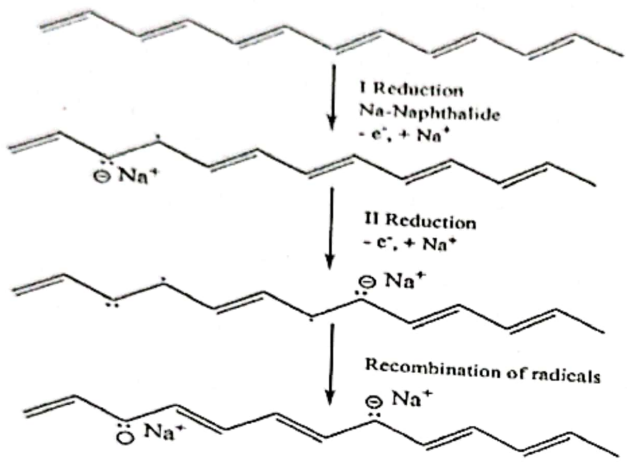
In reductive doping technique, pi-backbone of a polymer is partially reduced by a suitable reducing agent. This facilitates the formation of negative charged sites on the pi-backbone and are responsible for conduction. The most commonly used reducing agents are: sodium napthalide, intetra hydro furan.

Mechanism of conduction:

The addition of an electron to the polymer back bone by using a reducing agent generates a radical ion polaron.

A second reduction of chain containing polaron, followed by the recombination of radicals yields two charged (-ve) carriers on each chain.

These charge sites on the polymer chains are compensated by cations (Na+ions) formed by the reducing agent.



Reactions of n- doping of polyacetylene

OR

2(a) In a sample of a polymer, 100 molecules have molecular mass 10^3g/mol, 250 molecules have molecular mass 10^4g/mol, and 300 molecules have molecular mass 10^5g /mol, **Calculate** the number average and weight average molecular mass of the polymer, **Calculate** PDI and comment on it. 5

Sol

Sl No	No of Molecules(N)	Molecular Mass(M) g/mol
1	N_1= 100	M_1= 10^3
2	N_2=250	M_2= 10^4
3	N_3= 300	M_3= 10^5

Number average molecular mass ($\overline{Mn}$) is given by:

$$\overline{Mn} = \frac{N_1M_1 + N_2M_2 + N_3M_3 + \ldots\ldots}{N1 + N2 + N3 + \ldots\ldots\ldots\ldots}$$

$$\overline{Mn} = \frac{100*10^3 + 250*10^4 + 300*10^5}{100+250+300} = 50153\ g/l$$ 1

Weight average molecular mass ($\overline{Mw}$) is given by: 1

$$\overline{M_w} = \frac{N_1M_1^2 + N_2M_2^2 + N_3M_3^2 + \ldots\ldots}{N_1M_1 + N_2M_2 + N_3M_3 + \ldots\ldots\ldots\ldots}$$ 1

$$\overline{Mw} = \frac{100*(10^3)*(10^3) + 250*(10^4)*(10^4) + 300*(10^5)*(10^5)}{100*10^3 + 250*10^4 + 300*10^5} = 92794\ g/l$$ 1

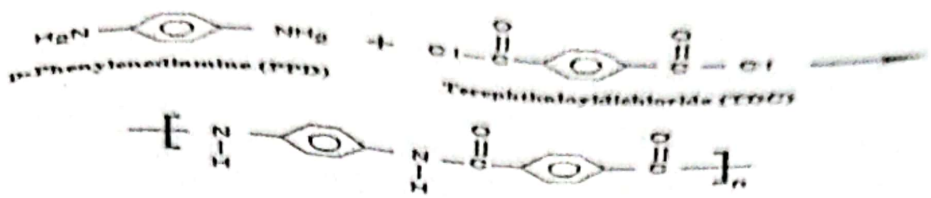
$$PDI = \frac{\overline{Mw}}{\overline{Mn}} = \frac{92794}{50153} = 1.85$$ 1

PDI >1 , the given polymer is less homogeneous and poly disperse in nature.

Explain the preparation, properties, and commercial applications of Kevlar fibre. 5

Kevlar is a polyamide, in which all the amide groups are separated by para-phenylene groups. The Chemicalcomposition of Kevlar is poly para phenylene terephthalamide.

Synthesis:



Kevlar is fiber embedded in an epoxy resin polymer matrix is called Polymer Composite.

Properties of Kevlar

Sol

1. Kevlar is crystalline, lightweight and non-flammable
2. Resistant to heat, impact, scratch
3. Withstands harsh environmental conditions
4. Abrasion and corrosion resistant
5. High tensile strength
6. Resistant to Chemicals

Applications

1. It is used in lightweight boat hulls. Aircraft panels, Racecars
2. Bulletproof vests and combat helmets
3. Reinforce material for car tires, bicycle tires, which reduces puncture rate
4. Marine current turbine and wind turbine
5. Ropes and cables
6. Fiber-optic cables for communication, data transmission and ignition

PART-B — 5

3(a) **Explain** the principle, working and applications of conductometric sensors

Conductometric Sensors:

Conductometric sensors are chemical sensors determines concentration of analyte on the basis of measurement of changes in electrical conductivity when a specific analyte interacts between the electrodes. — 1

Principle:

The basic principle of conductometric detection involves a reaction that can change the concentration of ionic species. The ions or electrons produced during an electrochemical reaction leads to changes in electrical conductivity or resistivity of the solution or current flow. The change in conductivity is measured and correlated with the concentration of the analyte in the sample. The final output is a quantitative measure of the concentration of the analyte. — 1

Conductance of a solution depends on

The concentration of ions (number of ions).

Sol Mobility of ions. Mobility of ion depends on its size. Smaller the size higher is the mobility and higher is the electrolytic conductance.

Working:

Transducer used in conductometric sensor is called as conductivity cell. It is made of two platinum foils with unit cross sectional area and unit distance between them. Volume between two electrodes is 1cm3Conductance of unit volume of the solution is called as specific conductance. There will be change in specific conductance of solution when there is change in number of ions or type of ion. This change is measured using conductivity cell.The conductivity is a result of dissociation of an electrolyte, into ions. The migration of the ions is induced by an electrical field. When a potential difference is applied to the electrodes, there is an electrical field within the electrolyte, so the positively charged ions move towards cathode and negatively charged ions are move towards anode. Thus, the current in the electrolyte is conducted by the ion movement towards the electrodes where the ions are neutralized and isolated as neutral atoms or molecules. — 2

This chemical change is recognized by working electrode or transducers and converts this chemical change into electrical signal.

Applications:

Conductometric sensors can be used to monitor any chemical which can change the electrolytic conductance of solution on chemical reaction.

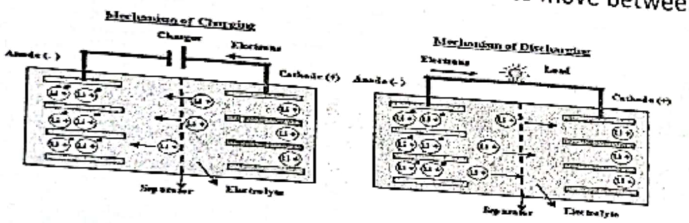
It is used to estimate acids , bases and their mixtures in the sample.

It is used to check the amount of ionic impurities in water samples.

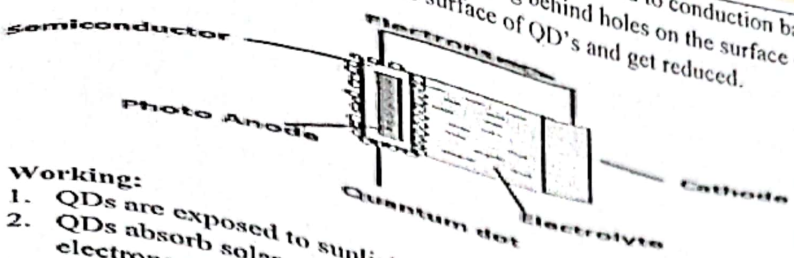
It is used in measuring acidity or alkalinity of sea water and fresh water.

Conductometic biosensors are used in biomedicine, environment monitoring, biotechnology and agriculture related applicaions.

Used in enzyme catalysis to determine analyte concentration and enzyme activity and selectivity.

3(b)	**Illustrate** the construction, working and applications of Lithium-ion batteries	5
solu	**Construction:** Lithium ion battery uses lithium intercalated electrodes. The following are battery components used in the construction of LIBs • Anode (negative electrode): Layered structure intercalated graphite and binder coated on a copper foil. • Cathode (positive electrode): Layered structure lithium cobalt oxide(LiCoO2) or lithium manganese oxide (LiMnO2) mixed with conductor and binder are coated on aluminum foil Electrolyte: Lithium hexafluoro phosphate (orlithium per chlorite or lithium tetrafluoro borate orlithium halide) dissolved in an organic solventsuch as propylene carbonate and ethylene carbonate with gelling agent. • Separator: Micro porous Polypropylene membrane which separates the cathode & anode and allowsthe movement of ionsfrom anode to cathode and cathode to anode . • Binder: Poly vinylidene fluoride • Container: Stainlesssteel or aluminium alloy. Cell representation: Lithiated ***Graphite layer /LiPF6*** dissolved ***in organic solvent & gelling agent/LiCoO2***	2
	Working Principle: Anode and cathode can insert lithium ions into their layered structures reversibly. During intercalation ions move into the electrode. During the reverse process (deintercalation)ions move back out. The electrolyte conducts Lithium-ions to move between the electrodes.	1
		
	Anode: $LiC_6 \underset{Recharging}{\overset{Discharging}{\rightleftharpoons}} Li^+ + 6C + e^-$	1
	Cathode: $CoO_2 + Li^+ + e^- \underset{Recharging}{\overset{Discharging}{\rightleftharpoons}} LiCoO_2$	
	Overall reaction: $LiC_6 + CoO_2 \underset{Recharging}{\overset{Discharging}{\rightleftharpoons}} LiCoO_2 + 6C$	1
	Applications of LIBs: • High energy density LIBs are used in electronic devices such as mobile phones, laptops, note PC, portable CD player, semiconductor driven audio electric devices. • Used for emergency power backup or an uninterruptable power supply. • Used in Electric vehicles. • Renewable Energy storage systems. • Defence and Aerospace applications	
3(c)	**What** are Quantum Dot Sensitized Solar Cells (QDSSC's)? **Explain** the working Principle, Properties and Applications.	5
Sol	A quantum dot solar cell (QDSC) is a solar cell that uses quantum dots as the absorbing photovoltaic material.	1
	It is used to replace bulky materials such as silicon, or copper indium gallium selenide.	
	Quantum dots have band gaps that are adjustable through a wide array of energy levels by changing the size of the dots.	
	Working:	
	1. QDs are exposed to sunlight.	

2. Q... ...ergy, electrons move from valence band to conduction band. These electrons are transferred to semiconductor, leaving behind holes on the surface of QD's
3. Electrolyte take up the holes from the surface of QD's and get reduced.



1

Working:

1. QDs are exposed to sunlight.
2. QDs absorb solar energy, electrons move from valence band to conduction band. These electrons are transferred to semiconductor, leaving behind holes on the surface of QD's
3. Electrolyte take up the holes from the surface of QD's and get reduced. 1

$$S^{2-} + 2h^{+} \rightarrow S$$

4. Electrons flows from anode to cathode through external circuit.
5. At cathode, electrolyte is regenerated taking up electrons from cathode. 1

$$S + S^{2-}_{x-1} \rightarrow S^{2-}_{x} \quad (x = 2 \text{ to } 5)$$

$$S^{2-}_{x} \rightarrow S + S^{2-}_{x-1}$$

$$S + 2e^{-} \rightarrow S^{2-}$$

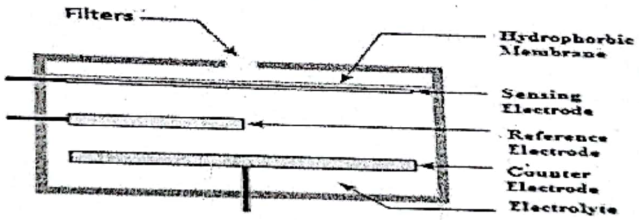
60109

Properties

They have a favourable power to weight ratio with high efficiency.
Their power consumption is low.
There is an increase of electrical performance at low production costs.
Their use is versatile and can be used in windows, not just rooftops.

Applications of QDSSC:

- Used for biological labelling.
- Imaging and detection and as efficient fluorescence resonance energy transfer donors.
- It is used as light-emitting diodes, photoconductors, photodectors and photovoltaic.
- It is used in biomedicine and environment.
- It is used in catalysis and other reactions.

4(a)	**Explain** the woring principle of electrochemical gas sensors for the detection of SOx and NOx	1
Sol	**Electrochemical gas sensors for SOx and NOx.**  Filters: Used to prevent unwanted contaminants, mainly particulate matter Membrane: A gas-permeable membrane is used to regulate the gas flow into the sensors. It allows only analyte gas to pass and prevent the leakage of the electrolyte. Electrodes: two or three electrodes are used on the requirement. Working or sensing, counter and reference electrode. Electrolyte: Electrolyte should be ionic conductor and chemically stable. Main role is , it transport charge within the sensor, contact all electrodes effectively and solubilise the reactant and product for efficient transport. Sensors for SOX: The sensors contains two or three electrodes Sensing electrode: Au/Nafion Electrolyte: 0.5M H2SO4 **Working:** The diffusion of gas analyte through filter, membrane and then finally through electrolyte on to the surface of sensing electrode.	1 2

- Adsorption of analyte gas molecules on the surface of sensing electrode.
- Oxidation of analyte on the surface of sensing electrode, liberating electrons.
- Desorption of product from the electrode surface.
- Diffusion of the products away from the reaction zone to bulk of electrolyte.

$SO_2 + 2H_2O \rightarrow SO_4^{2-} + 4H^+ + 2e^-$

Sensors for NO2: The sensors contain two or three electrodes.
Sensing electrode: Au, Pt/Nafion.
Electrolyte: 10 M H2SO4

- The diffusion of gas analyte through filter, membrane and then finally through electrolyte on to the surface of sensing electrode.
- Adsorption of analyte gas molecules on the surface of sensing electrode.
- Oxidation of analyte on the surface of sensing electrode, liberating electrons.
- Desorption of product from the electrode surface.
- Diffusion of the products away from the reaction zone to bulk of electrolyte.

$NO_2 + 2H^+ + 2e^- \rightarrow NO + 2H_2O$

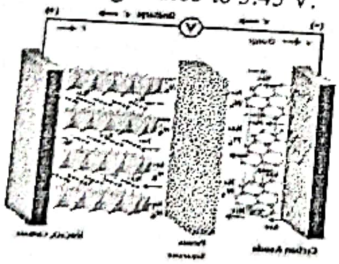
Sensors for NO:
The sensors contain two or three electrodes.
Sensing electrode: Au/NASICON
Working:
Electrolyte: NaNO2
Working:

- The diffusion of gas analyte through filter, membrane and then finally through electrolyte on to the surface of sensing electrode.
- Adsorption of analyte gas molecules on the surface of sensing electrode.
- Oxidation of analyte on the surface of sensing electrode, liberating electrons.
- Desorption of product from the electrode surface.
- Diffusion of the products away from the reaction zone to bulk of electrolyte.

$NO + 2H_2O \rightarrow NO_3^{2-} + 4H^+ + 3e^-$

1

4(b)	**Illustrate** the construction, working and uses of Na-Ion battery.	
Sol	SODIUM-ION BATTERY (SIB) Composition of the battery: Reactive species at anode : Carbon Reactive species at cathode : NaCoO2 V Electrolyte : Ethylene carbonates (EC), Diethyl carbonate (DEC) Separator : Polypropylene Output Voltage : 1.85 to 3.45 V.	2



Working of SIB:
During charging sodium ions in cathodic side (positive electrode) is migrated and move towards anodic side (negative electrode)

2

$Cathodic\ Reaction: NaCoO_2 \rightarrow Na_{(1-x)}CoO_2 + xNa^+ + xe^-$
$Anodic\ Reaction: xNa^+ + xe^- + 6C \rightarrow xNaC_6$
$Overall\ Reaction: NaCoO_2 + 6C \leftrightarrow Na_{(1-x)}CoO_2 + xNaC_6$

During discharging sodium ions move from anode to cathode.
$Anodic\ Reaction: xNaC_6 \rightarrow xNa^+ + xe^- + 6C$
$Cathodic\ Reaction: Na_{(1-x)}CoO_2 + xNa^+ + xe^- \rightarrow NaCoO_2$
$Overall\ Reaction: Na_{(1-x)}CoO_2 + xNaC_6 \rightarrow NaCoO_2 + 6C$

Uses of SIB:
The Na- ion batteries are used in mobile phones, cameras, calculators, LCD TVs, pagers, to operate laptop computers, in aerospace applications

1

What are disposable sensors? Mention the advantages of disposable sensors.

Disposable sensors:

Disposable sensors are low-cost and easy-to-use sensing devices designed for short-term or rapid single-point measurements. 2

Portable sensors used for on-spot analysis using disposable strip with receptor and electrode printed on it is called disposable sensor.

Advantages of disposable sensors:

- They transduce physical, chemical, or biological changes in their environment to an analytical signal. 3
- Disposable sensors are biodegradable and sustainable
- They have a short duration of analysis and fast response times.
- It provides digitized chemical and biological information.
- Prevents the contamination of samples

560109

Course In charge

Head of the Department

Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management
Bangalore - 560 109

Principal
Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Management
Bengaluru - 560 109

NGINEERING AND MANAGEMENT, BANGALORE -560109
DEPARTMENT OF APPLIED SCIENCE
SESSION: 2023-2024 (EVEN SEMESTER)
II SESSIONAL TEST QUESTION PAPER
SET-A

Degree : B.E
Branch : CSE & AI-DS
Course Title : Applied Chemistry for CSE Stream
Duration : 75 Minutes

USN

Semester : II
Course Code : BCHES202
Date : 29/5/2024
Max Marks : 25

Note: Answer ONE full question from each part.

Q No.	Question	Marks	K-Level	CO mapping
	PART-A			
	In a sample of a polymer, 100 molecules have molecular mass 10^3g/mol, 250 molecules have molecular mass 10^4g/mol, and 300 molecules have molecular mass10^5g/mol, **Calculate** the number average, weight average molecular mass of the polymer and **Find** PDI and comment on it.	5	Applying K3	CO2
(b)	**Explain** the preparation, properties, and commercial applications of Kevlar Fiber	5	Understanding K2	CO2
	OR			
2(a)	In a sample of a polymer, 20% molecules have molecular mass 15000 g/mol,35% molecules have molecular mass 25000 g/mol, and remaining molecules have molecular mass 20000 g /mol, **Calculate** the number average and weight average molecular mass of the polymer and **Find** PDI, comment on it.	5	Applying K3	CO2
(b)	**Describe** the conduction mechanism in Polyacetylene through oxidative or reductive doping technique.	5	Understanding K2	CO2
	PART-B			
	Using gas sensors **Illustrate** the working principle of electrochemical gas sensors for the detection of SOx and NOx	5	Applying K3	CO3
(b)	**Explain** Na-Ion battery construction, it's working and applications	5	Understanding K2	CO3
(c)	**What** are disposable sensors? **Mention** the advantages of disposable sensors.	5	Understanding K2	CO3
	OR			
4(a)	**Using** Electrochemical Sensors, **Illustrate** measurement of Dissolved Oxygen (DO)	5	Applying K3	CO3
(b)	Explain the construction, working and uses of Li-Ion battery.	5	Understanding K2	CO3
(c)	**Discuss** the detection of a ascorbic acid bio-molecule using disposable sensor also **write** the electro oxidation reaction.	5	Understanding K2	CO3

Course Incharge

HOD

Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management
Bangalore - 560 109

IQAC- Coordinator

Principal

Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Man
Bengaluru - 560 109

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

DEPARTMENT OF APPLIED SCIENCE
SESSION: 2023-2024 (EVEN SEMESTER)
III SESSIONAL TEST QUESTION PAPER
SET-A

USN | | | | | | | | | | |

Degree	:	B.E	Semester	: II
Branch	:	CSE & AI&DS	Course Code	: BCHES202
Course Title	:	Applied Chemistry CSE-Stream	Date	: 27/6/2024
Duration	:	75 Minutes	Max Marks	: 25

Note: Answer ONE full question from each part.

Q No.	Question	Marks	K-Level	CO mapping
	PART-A			
1(a)	Explain construction, working and applications LCD.	5	Understanding K2	CO4
(b)	Applying photoactive and electroactive principle, illustrate the working of optoelectronic devices in display system.	5	Applying K3	CO4
(c)	Discuss any four properties and applications of QLED.	5	Understanding K2	CO4
	OR			
2(a)	What are Memory Devices? Explain the Classification of electronic memory devices with examples.	5	Understanding K2	CO4
(b)	Using donor acceptor organic polymers, illustrate the working of Polymer memory device.	5	Applying K3	CO4
(C)	Explain properties and applications of light emitting material Poly[9-vinylcarbazole] (PVK)] for optoelectronic devices.	5	Understanding K2	CO4
	PART-B			
3(a)	Explain the need for e-waste management concerning to global perspective.	5	Understanding K2	CO5
(b)	Utilizing the metal extraction technique, illustrate the extraction of gold from e-waste.	5	Applying K3	CO5
	OR			
4(a)	Discuss the toxic materials used in the manufacturing of electronic and electrical products.	5	Understanding K2	CO5
(b)	Applying pyrometallurgical and hydrometallurgical technique, illustrate the recycling of e-waste.	5	Applying K3	CO5

Course Incharge

HOD 24/6/24
Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Manageme..
Bangalore - 560 109

IQAC- Coordinator

Principal
Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Managemer
Bengaluru - 560 109

SEM

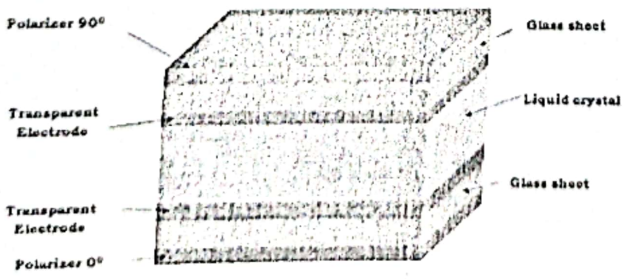
SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109
DEPARTMENT OF APPLIED SCIENCE
SESSION: 2023-2024 (EVEN SEMESTER)
III SESSIONAL TEST QUESTION PAPER
SET-A

Degree : B.E
Branch : CSE & AI&DS
Course Title : Applied Chemistry CSE-Stream
Duration : 75 Minutes

USN

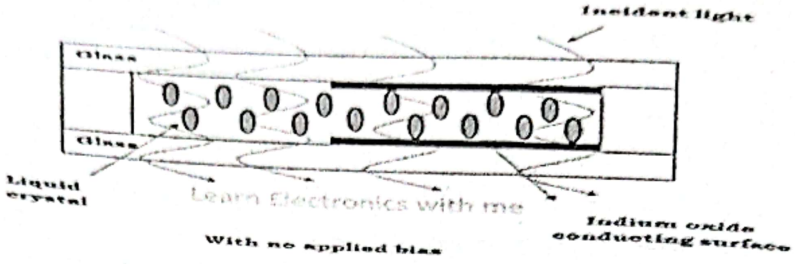
Semester : II
Course Code : BCHES202
Date : 27/06/2024
Max Marks : 25

Note: Answer ONE full question from each part

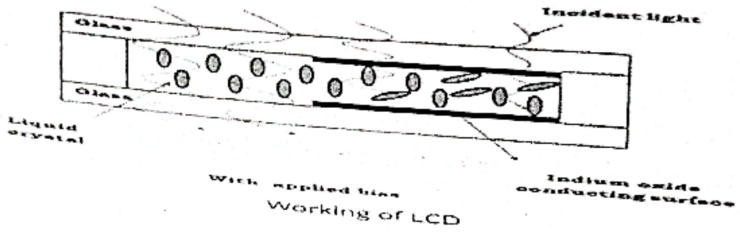
Q. No.	Questions with Scheme & Solution	Marks
1(a)	PART-A Explain construction, working and applications LCD.	5
1(a)	**Construction and working principle of liquid crystal display:** The electro-optic effect of liquid crystals controls brightness/ darkness of the light emerging from its elements and this is used in information displays Information is passed on to the user, using liquid crystals which control the brightness/darkness of the parts of a display.	1
	• **Construction of display** Liquid crystal displays are used in a number of applications from clock to oscilloscope. 1. In these devises a thin film of liquid crystals is placed between two sheets of glass. 2. One of which is coated on one side with a thin layer of an electrically conductive material such a indium oxide 3. When no current is passing though the conductive coating, the molecules (liquid crystal molecules) are uniformly oriented and the light can pass though the cell .	1
1(a)	4. When the current is applied the molecules alignment changes (because the liquid crystal molecules are polar) and the cell appears opaque or black. Thus number or a letter is displayed in black against a silvery back ground.	
	 Construction of LCD	1

- **Working Of display**

When the light of the display is ON and electric field is not applied to any of the segments, then all the segments appear bright. Numeric display will not display any number as shown in the figure.



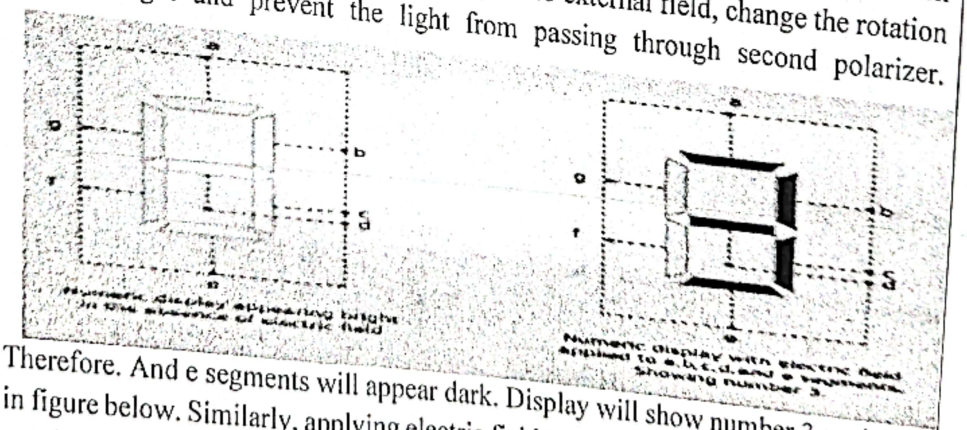
Working of LCD



Working of LCD

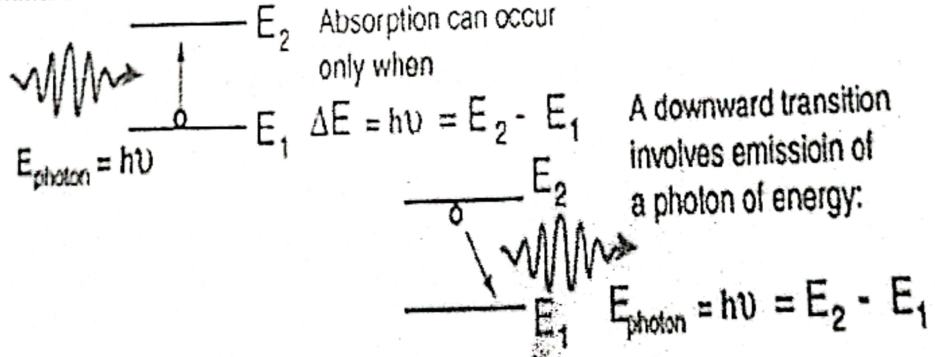
In this case, light radiation passing through first polarizer will be rotated by a liquid crystal to an extent corresponding to angle of inclination between two polarizers Hence, light passes through second polarizer also and display appears bright when light is ON.

Now, if electric field is applied to a, b, c, d, and e segments of the number. Then liquid crystal molecules in this part are aligned to external field, change the rotation angle of light and prevent the light from passing through second polarizer.



Therefore. And e segments will appear dark. Display will show number 3 as shown in figure below. Similarly, applying electric field to only b and c segments will show number 1, applying electric field to only a, b and c segments will show number 7 and applying electric field to all segments will show number 8. In this way 0 to 9 numbers can be displayed by applying electric field across appropriate segments.

Applications of liquid crystals in display devices:

	Liquid crystal may be described as a distinct state of matter in which the degrees of molecular ordering lie intermediate between the ordered crystalline solid state and the completely disordered liquid. The liquid crystal state is also referred to as mesophase. Liquid crystal displays operate at low voltages (a few volts) and consume less power as compared to other display and hence are used in: a) Watches, calculators, mobile telephones, laptop computers and related electronic gadgets. Indicators in automobile dashboards, airplane cockpits, traffic signals advertisement boards and petrol pump indicators.	
1(b)	**Applying** photoactive and electroactive principle, **illustrate** the working of optoelectronic devices in display system.	5
Sol	Materials used in optoelectronic devices are referred to as photo and electroactive materials. These are commonly semiconducting materials. These are capable of absorbing light radiation and eject electrons or emit light when electric field is applied. Eg. 1. Inorganic semiconductors like Si, Ge etc., 2. Organic Semiconductors like pentacene, perfluoropentacene etc 3. conducting polymers like **Polythiophenes (P3HT) , Poly[9- vinylcarbazole] (PVK)]** 4. Nanomaterials like Nano Silicon **Photoactive materials :** are those that can absorb light and convert it into an electrical signal. These materials are used in photo sensors and photovoltaic cells, which are commonly found in solar panels. When light falls on a photoactive material, it releases electrons, which generate an electric current  	1 4 is. bed the nce ergy
(C)	**Discuss** any four properties and applications of QLED.	5
	Properties of QD-LED Superior performance of QD-LEDs is due to their unique optical and electronic features as given below: 1. Unique properties of QDs are mainly due to the nano size of crystals. 2. High quantum yields 3. High molar extinction Co-efficient 4. Large effective stokes shifts 5. Broad excitation profiles 6. Narrow/ Symmetric emission spectra	3

7. High resistance to reactive oxygen
8. High resistance to metabolic degradation
9. High brightness.
10. High efficiency with long lifetime.
11. More flexibility.
12. High quality lighting with superior color gamut.
13. High color rendering index.

Applications:

1. QD-LED are superior to other display technologies like liquid crystal displays (LCDs), OLEDs and plasma displays due to ideal blend of features
2. QD-LEDs are more reliable solutions for flat-panel TV screens, digital cameras, mobile phones and personal gaming equipment's.
3. QD-LED displays will be large and flexible and would not deteriorate as easily as OLEDs.

2

OR

2(a) What are Memory Devices? **Explain** the Classification of electronic memory devices with examples. **5**

Memory Devices:

An electronic memory device is a form of semiconductor storage which is fast in response and compact in size, and can be read and written when coupled with a central processing unit (CPL processor).

Classification of electronic memory devices

According to the device structure, electronic memory devices can be divided into four primary categories: transistor type, capacitor type, resistor type and charge transfer- type. 1

1. Transistor-Type Electronic Memory:

A transistor is a miniature electronic component that can work either as an amplifier or a switch. Computer memory chip consists of billions of transistors, each transistor is working as a switch, which can be switched ON or OFF. Each transistor can be in two different states and store two different number ZERO and ONE. Since chip is made of billions of such transistors and can store billions of Zeros and Ones, and almost every number and letter can be stored. 1

2. Capacitor-Type Electronic Memory 1

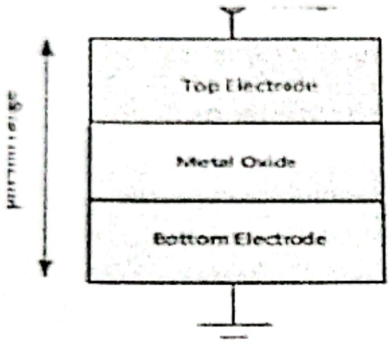
A capacitor consists of two metal plates which are capable of storing an electric charge. It is like a battery that holds data based on energy. If the capacitor is charged, it holds the binary numeral,"1" and holds "0" when the cell is discharged. If the parallel plates of a capacitor are separated by dielectric layer, charges dissipate slowly and memory would be volatile.

On the other hand, if the medium between the electrodes is ferroelectric in nature, can maintain permanent electric polarization that can be repeatedly switched between two stable states (bistable) by an external electric field. Thus, memory based on ferroelectric capacitors (FeRAM) is non-volatile memory.

1

3. Resistor-Type Electronic Memory

Memory devices containing switchable resistive materials are classified as resistor-type memory, or resistive random access memory (RRAM). Resistor-type electronic memory usually has a simple structure, having a metal-insulator-metal structure generally referred to as MIM structure. The structure comprises of an insulating layer (I) sandwiched between the two metal (M) electrodes and supported on a substrate (glass, silicon wafer, plastic or metal foil). Initially, the device is under high resistance state or "OFF" and logically "0" state, when resistance changed or under external applied field changes to low resistance state or "ON" logical value "1",

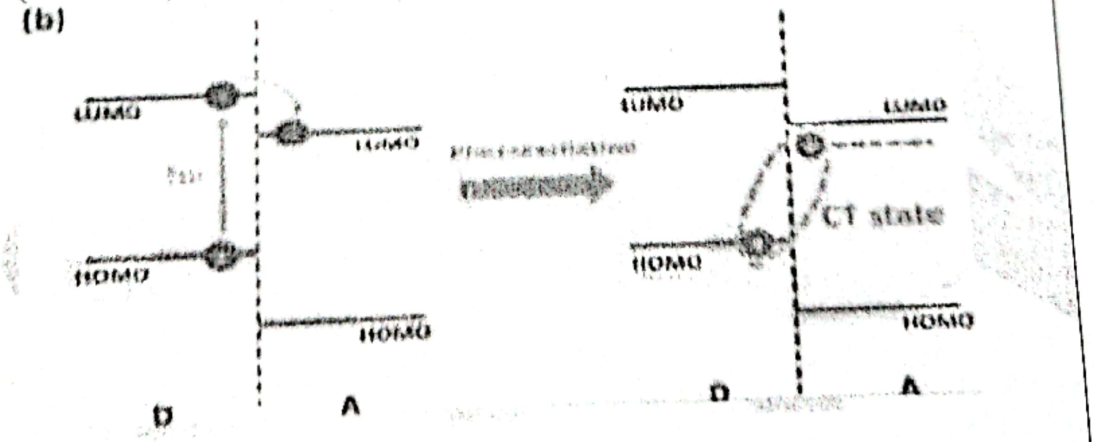


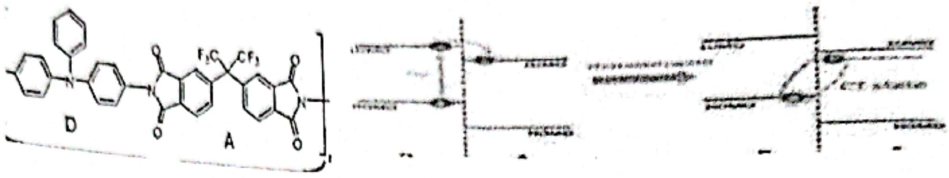
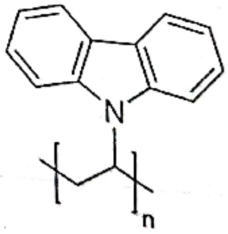
4. Charge Transfer Effects

A charge transfer (CT) complex is defined as an electron donor acceptor (D-A) complex, characterized by an electronic transition to an excited state in which a partial transfer of charge occurs from the donor moiety to the acceptor moiety. The conductivity of a CT complex is dependent on the ionic binding between the D-A components. 1

If the donor has intermediate size and ionization potential, it tends to form a weakly ionic salt with the acceptor, which possesses incomplete CT (0.4<?<0.7) and thus is potentially conductive.

(b)



2(b)	Using donor acceptor organic polymers, illustrate the working of Polymer memory device.	5
	Polymer memory devices: Organic polymer used for organic memory device is Polyimide with Donor-Triphenylamine and Acceptor- phthalimide. **Donor: Triphenyl Amine group (TPA)**  **Acceptor: Phthalimide group Hexafluoro isopropylidene (6F): Increases the solubility of PI** **The donors and acceptors of PIs contribute to the electronic transition based on an induced charge transfer (CT) effect under an applied electric field.** 1. When an electric field more than threshold energy is applied, the electrons of the HOMO (TPA unit) is excited to LUMO. 2. The energy of LUMO of donor and acceptor are similar and therefore, after excitation the electron transferred to LUMO (acceptor), generating a CT state. 3. This permits the generation of holes in the HOMO, which produces the open channel for the charge carriers to migrate through. 4. Therefore, Field-induced charge transfer from Triphenylamine to Phthalimide exhibit the switching behavior (bistable states ON/OFF). Donor Acceptor type conjugated polymers are used to fabricate different types of memory device, such as volatile DRAM and SRAM devices, and non-volatile WORM and Flash devices	3 2
2(C)	**Explain** properties and applications of light emitting material Poly[9-vinylcarbazole] (PVK)] for optoelectronic devices.	5
	Properties and applications of Light emitting materials - Poly[9-vinylcarbazole] (PVK)] suitable for optoelectronic devices : **Properties:** 1. It is a semiconducting polymer and an electron acceptor converts ultra-violet (UV) light into electricity. 2. PVK has a band gap of 3.4 eV, optical absorption edge stating at 350 nm capable of absorbing Ultra- Violet light. 3. The PVK film is hydrophobic, thermally stable with relatively high glass transition temperature (Tg) of 200 °C 4. The PVK solution also showed good wettability, and provide uniform thin films on glass/ITO substrates. **Applications:** 1. PVK is used in OLEDs for light harvesting 2. Used in the fabrication of light emitting diodes and laser printers. 3. Used in the fabrication of organic solar cells when combined with TIO on glass substrate. 4. Used in the fabrication of solar cells when a combined with Perovskite materials. 5. PVK-Perovskite junction is used in Light- Emitting Diodes with Enhanced Efficiency and stability.	 3 2

	PART-B	
3(a)	Explain the need for e-waste management concerning to global perspective.	5
Sol	**From a global perspective, stakeholders in the environmental management of e-waste may include:** 1. **International organizations:** such as the United Nations, World Trade Organization, and the International Telecommunication Union, that are responsible for setting global standards for e-waste management and promoting cooperation and collaboration among countries. 1 2. **Transnational corporations:** responsible for the design, production, and distribution of electronic products on a global scale, and have a significant impact on e-waste management practices. 1 3. **Global e-waste trade networks:** responsible for the transportation and processing of e-waste between countries and may impact the environmental and health outcomes of e-waste management. 1 4. **Governments of developed and developing countries:** responsible for creating and enforcing regulations and policies to manage e-waste, as well as promoting public awareness and education about e-waste management. 1 5. **Environmental organizations:** responsible for advocating for sustainable and responsible e-waste management practices and raising public awareness about e-waste issues on a global scale. 6. **International community:** including consumers, NGOs, and civil society organizations, that can raise awareness about e-waste issues, demand responsible e-waste management practices, and push for change at the international level. 1	
3(b)	**Utilizing** the metal extraction technique, **illustrate** the extraction of gold from e-waste.	5
Sol	**Extraction of gold from e-waste :** ***Principle:*** The principle behind the extraction of gold from e-waste is based on the fact that gold is a relatively non-reactive metal, which allows it to be recovered from complex electronic waste matrices through a series of chemical and physical processes. Experimental procedure: 1 1. **Collection and segregation of e-waste:** The first step involves collecting and segregating the e-waste into different categories, such as computer motherboards, cell phones, and other electronic devices. 1 2. **Physical separation:** The e-waste is physically separated into different components, such as plastics, metals, and glass.	

	3. **Leaching:** The metals, including gold, are leached from the e-waste using a suitable reagent, such as aqua regia (a mixture of hydrochloric acid and nitric acid), to dissolve the gold. $Au + HNO_3 + 4HCl \rightarrow HAuCl_4 + NO + 2H_2O$ 4. **Precipitation:** The dissolved gold is then precipitated out of the solution through the addition of a suitable reducing agent, such as sodium metabisulfite. $2H[AuCl_4] + 3Na_2S_2O_5 + 3H_2O \rightarrow 2Au + 3SO_2 + 3Na_2SO_4 + 8HCl$ 5.**Purification:** The precipitated gold is then purified through processes such as ion exchange, electrowinning, or distillation, to remove impurities and improve its quality. 6.**Metal Recovery Stage:** In this stage Gold metal can be recovered from the obtained complex using methods like Electrodeposition. Solvent – Extraction, Ion – Exchange, Precipitation, etc., **Ex: - Electrodeposition:-** In this method pure gold metal taken as cathode and inert anode are dipped in obtained leached complex solution. When current is applied gold is electrodeposited on cathode.	1 1 1
4(a)	**Discuss** the toxic materials used in the manufacturing of electronic and electrical products.	5
Sol	**Toxic materials used in manufacturing of Electronic and Electrical products.** **Electronic and electrical products can contain a variety of toxic materials, including:** 1. used in some fluorescent lights, batteries, and other electronic devices. 2. **Cadmium:** Cadmium is a toxic heavy metal used in rechargeable batteries, pigments, and plastic stabilizers. 3. **Polyvinyl Chloride (PVC):** PVC is a common plastic used in electronic cables and other components. It can release toxic chemicals, such as dioxins, when burned or during disposal. 4. **Brominated flame retardants (BFRs):** BFRs are used in the manufacture of electronic products to prevent fires. However, they are toxic and can harm the environment and human health. 5. **Barium:** Barium is used in some electronic components, including cathode ray tubes. 6. Rechargeable Batteries contains Lithium is used in batteries, but it can be toxic if not handled properly. Cadmium, Lead, Sodium, Lithium, Nickel etc.,	1 1 1 1 1

	7. Chlorofluorocarbons (CFCs) are toxic chemicals that were widely used as coolants and solvents in electronic products, such as refrigerators, air conditioners. They cause ozone depletion.	1
4(b)	**Applying** pyrometallurgical and hydrometallurgical technique, **illustrate** the recycling of e-waste.	5
Sol	**Hydrometallurgical extraction of E waste:** E-waste hydrometallurgical extraction is a process used to extract valuable metals and other materials from electronic waste through chemical reactions in aqueous solutions. The process typically involves the following steps: 1. Pre-treatment: This involves the fragmentation and size reduction of electronic waste to prepare it for further processing. 2. Leaching: The e-waste is treated with chemical reagents in a solution to dissolve the metals and other materials, creating a leachate. 3. Separation: The leachate is then processed to separate and purify the metals and other materials, through methods such as precipitation or ion exchange. 4. Recovery: The extracted metals and other materials are then recovered and processed for reuse. Hydrometallurgical extraction is a more environmentally friendly alternative to thermal treatments, as it generates less hazardous waste and can be more easily regulated to minimize environmental impact. 5. Recovery: The extracted metals and other materials are then recovered and processed for reuse. Hydrometallurgical extraction is a more environmentally friendly alternative to thermal treatments, as it generates less hazardous waste and can be more easily regulated to minimize environmental impact. **Pyrometallurgical methods E-waste recycling:** E-waste pyrometallurgical methods refer to the process of extracting valuable metals and other materials from electronic waste using high temperatures. These methods include: 1. Smelting: The e-waste is melted in a furnace and then separated into individual metals and other materials. 2. Refining: The metals from the smelted e-waste are further processed to remove impurities and improve their quality. 3. Incineration: Electronic waste is burned at high temperatures to reduce its volume and recover metals. Pyrometallurgical methods are effective at recovering valuable metals from e-waste, but they also generate hazardous byproducts and require significant energy inputs. Additionally, these methods can pose a risk to the environment and human health if not properly regulated and monitored	3 2

Head of the Department 24/6/24

Principal
Dr. K. RAMA NARASIMHA

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

DEPARTMENT OF APPLIED SCIENCE

SESSION: 2023-2024 (EVEN SEMESTER)

III SESSIONAL TEST QUESTION PAPER

SET-B

USN | | | | | | | | | |

Degree	:	B.E	Semester	: II
Branch	:	CSE & AI&DS	Course Code	: BCHES202
Course Title	:	Applied Chemistry CSE-Stream	Date	: 27/6/2024
Duration	:	75 Minutes	Max Marks	: 25

Note: Answer ONE full question from each part.

Q No.	Question	Marks	K-Level	CO mapping
	PART-A			
1(a)	Applying photoactive and electroactive principle, illustrate the working of optoelectronic devices in display system.	5	Applying K3	CO4
(b)	Explain any four properties and applications of Polythiophenes (P3HT) suitable for optoelectronic devices.	5	Understanding K2	CO4
(c)	What are memory devices? Explain the classification of electronic memory devices with examples.	5	Understanding K2	CO4
	OR			
2(a)	Using donor - acceptor organic polymers, illustrate the working of Polymer memory devices.	5	Applying K3	CO4
(b)	Explain construction, working, properties and applications of OLED.	5	Understanding K2	CO4
(b)	Explain working of organic memory devices by taking p-type and n-type organic semiconductor materials.	5	Understanding K2	CO4
	PART-B			
3(a)	Utilizing the metal extraction technique, illustrate the extraction of gold from e-waste.	5	Applying K3	CO5
(b)	Explain the role of stakeholders in terms of producers, consumers, recyclers, and statutory bodies in the e-waste management.	5	Understanding K2	CO5
	OR			
4(a)	Applying pyrometallurgical and hydrometallurgical technique, illustrate the recycling of e-waste.	5	Applying K3	CO5
(b)	Explain sources and composition of e-waste.	5	Understanding K2	CO5

Course Incharge

HOD 24/6/24
Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management

IQAC- Coordinator

Principal
Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Management
Bengaluru - 560 109

R.L. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109
DEPARTMENT OF APPLIED SCIENCE
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III SESSIONAL TEST QUESTION PAPER
SET-B

Degree	:	B.E	USN		
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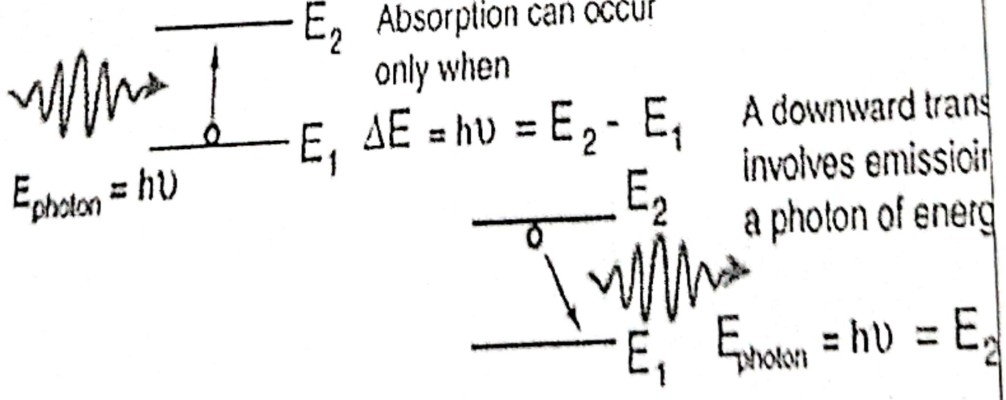
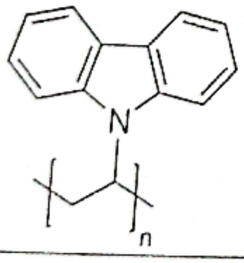
Note: Answer ONE full question from each part

Q. No.	Questions with Scheme & Solution	Marks
	PART-A	
1(a)	**Applying** photoactive and electroactive principle, **illustrate** the working of optoelectronic devices in display system.	5
1(a)	**Photoactive materials :** are those that can absorb light and convert it into an electrical signal. These materials are used in photo sensors and photovoltaic cells, which are commonly found in solar panels. When light falls on a photoactive material, it releases electrons, which generate an electric current **Electroactive materials:** are materials that can undergo a reversible change in their physical or chemical properties in response to an applied electrical stimulus. **working principle of Optoelectronic device.** If the photon has an energy larger than the energy gap, the photon will be absorbed by the semiconductor, exciting an electron from the valence band into the conduction band, where it is free to move. A free hole is left behind in the valence band. When the excited electron is returning to valence band, extra photon energy is emitted in the form a light. This principle is used in Optoelectronic devices.  	2 3
1(b)	**Explain** any four properties and applications of Polythiophenes (P3HT) suitable for optoelectronic devices.	5

	Properties and applications of Polythiophenes (P3HT) suitable for optoelectronic devices. Polythiophenes are conjugated polymers, environmentally and thermally stable material. Chemical structure of P3HT Poly (3-hexylthiophene) is a polymer with chemical formula ($C_{10}H_{14}S$). It is a polythiophene with a short alkyl group on each repeat unit. Highly ordered (P3HT) are composed of closely packed, p-p stacked (p-p distance of 0.33 nm). **Properties of nanostructured P3HT suitable for optoelectronic devices are listed as follows:** 1. P3HT is a semiconducting polymer with high stability and exhibits conductivity due to holes therefore considered as p-type semiconductor 2. Poly-3-hexylthiophene (P3HT) have great capability as light-absorbing materials in organic electronic devices. 3. P3HT has a crystalline structure and good charge-transport properties required for Optoelectronics. 4. P3HT has a direct-allowed optical transition with a fundamental energy gap of 2.14 eV. 5. Fundamental bandgap of P3HT is 490nm visible region, corresponding to Л→ Л* transition, giving electron-hole pair. **Applications:** 1. P3HT-ITO forms a p-n junction permit the charge carriers to move in opposite direction and hence, used in Photovoltaic devices. 2. It can be used as a positive electrode in Lithium batteries. 3. Used in the construction of Organic Solar Cells. 4. Manufacture of smart windows. 5. Used in the fabrication new types of memory devices.  	3 2
Sol		
1(C)	**What** are memory devices? **Explain** the classification of electronic memory devices with examples.	5
	Memory Devices: *An electronic memory device is a form of semiconductor storage which is fast in response and compact in size, and can be read and written when coupled with a central processing unit (CPL processor).* **Classification of electronic memory devices** According to the device structure, electronic memory devices can be divided into four primary categories: transistor type, capacitor type, resistor type and charge transfer- type.	1

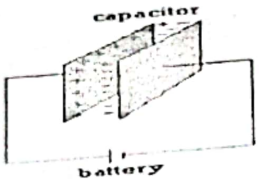
1. Transistor-Type Electronic Memory:

A transistor is a miniature electronic component that can work either as an amplifier or a switch. Computer memory chip consists of billions of transistors, each transistor is working as a switch, which can be switched ON or OFF. Each transistor can be in two different states and store two different number ZERO and ONE. Since chip is made of billions of such transistors and can store billions of Zeros and Ones, and almost every number and letter can be stored. 1

2. Capacitor-Type Electronic Memory

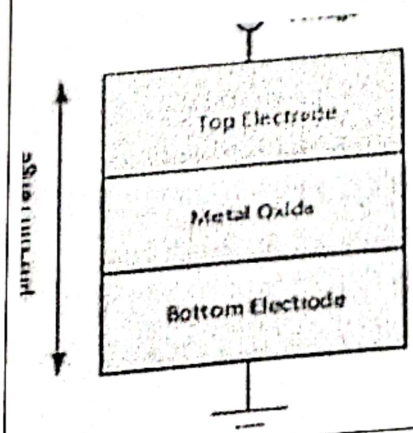
A capacitor consists of two metal plates which are capable of storing an electric charge. It is like a battery that holds data based on energy. If the capacitor is charged, it holds the binary numeral,"1" and holds "0" when the cell is discharged. If the parallel plates of a capacitor are separated by dielectric layer, charges dissipate slowly and memory would be volatile. 1

On the other hand, if the medium between the electrodes is ferroelectric in nature, can maintain permanent electric polarization that can be repeatedly switched between two stable states (bistable) by an external electric field. Thus, memory based on ferroelectric capacitors (FeRAM) is non-volatile memory.



3. Resistor-Type Electronic Memory

Memory devices containing switchable resistive materials are classified as resistor-type memory, or resistive random access memory (RRAM). Resistor-type electronic memory usually has a simple structure, having a metal-insulator-metal structure generally referred to as MIM structure. The structure comprises of an insulating layer (1) sandwiched between the two metal (M) electrodes and supported on a substrate (glass, silicon wafer, plastic or metal foil). Initially, the device is under high resistance state or "OFF" and logically "0" state, when resistance changed or under external applied field changes to low resistance state or "ON" logical value "1", 1

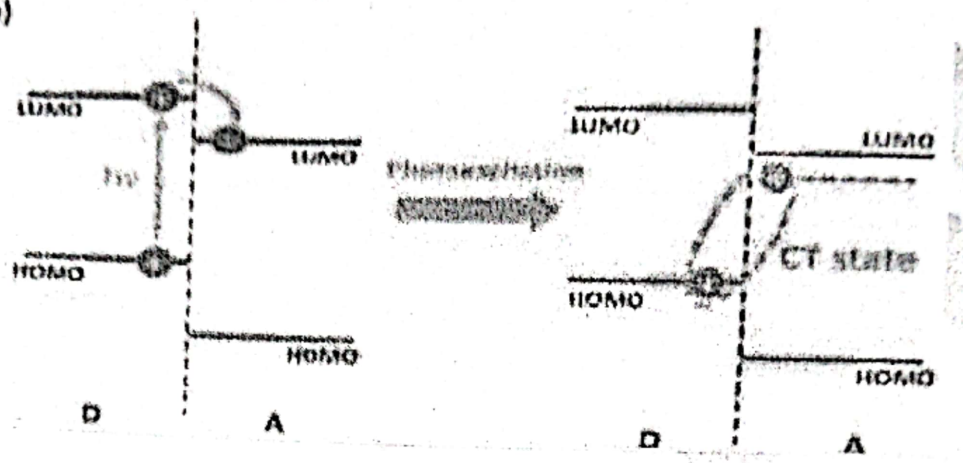


4. Charge Transfer Effects

A charge transfer (CT) complex is defined as an electron donor acceptor (D-A) complex, characterized by an electronic transition to an excited state in which a partial transfer of charge occurs from the donor moiety to the acceptor moiety. The conductivity of a CT complex is dependent on the ionic binding between the D-A components. 1

If the donor has intermediate size and ionization potential, it tends to form a weakly ionic salt with the acceptor, which possesses incomplete CT ($0.4<?<0.7$) and thus is potentially conductive.

(b)

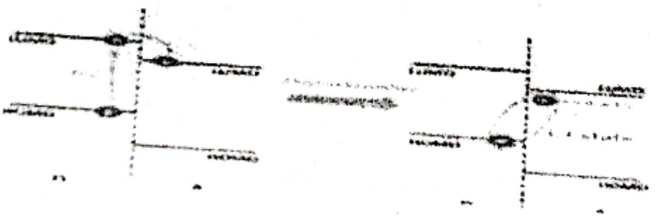


2(a)	**Using** donor - acceptor organic polymers, **illustrate** the working of Polymer memory devices.	5

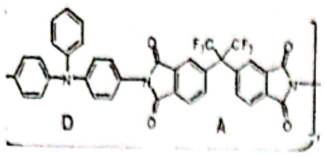
Polymer memory devices:

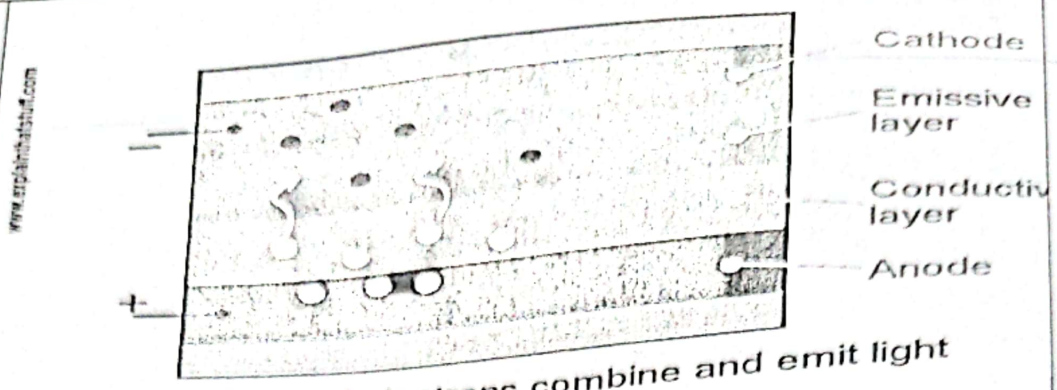
Organic polymer used for organic memory device is Polyimide with Donor- Triphenylamine and Acceptor- phthalimide.

Donor: Triphenyl Amine group (TPA)



1

	Acceptor: Phthalimide group Hexafluoro isopropylidene (6F): Increases the solubility of PI **The donors and acceptors of PIs contribute to the electronic transition based on an induced charge transfer (CT) effect under an applied electric field.**	1
Sol	 1. When an electric field more than threshold energy is applied, the electrons of the HOMO (TPA unit) is excited to LUMO. 2. The energy of LUMO of donor and acceptor are similar and therefore, after excitation the electron transferred to LUMO (acceptor), generating a CT state. 3. This permits the generation of holes in the HOMO, which produces the open channel for the charge carriers to migrate through. 4. Therefore, Field-induced charge transfer from Triphenylamine to Phthalimide exhibit the switching behavior (bistable states ON/OFF). Donor Acceptor type conjugated polymers are used to fabricate different types of memory device, such as volatile DRAM and SRAM devices, and non-volatile WORM and Flash devices.	1 1
2(b)	**Explain construction, working, properties and applications of OLED.**	5
Sol	**Organic Light Emitting Diodes (OLED)** **Principle involved in the working of OLED** Organic light emitting diode (OLED) is a carrier injection type electroluminescent device that uses organic materials. OLED devices consists of two electrodes, an anode and cathode and organic layers are placed between two electrodes. Multiple organic layers are used., in which each layer plays an intrinsic role. When a voltage is applied to an OLED device through anode and cathode, charge carriers are injected from the electrode to the organic layers. Anode injects holes (Positive charges) and cathode injects electrons (negative charges) to the system. The hole and electrons are transported to an emission site and recombined. Organic materials in the emission site are excited by recombination of holes and electrons. When the exited organic material returns to its ground state, then emission occurs. The emission frequency in an OLED depends upon the energy gap between the excited and ground states. Emission colour can be controlled by the energy gap between the excited and ground states.	2



1

Properties and Applications of OLED

OLED are mainly used in display and lighting applications. They exhibit several unique features which have made them so useful for display applications.
Important features of OLED

Properties:

1. OLEDs are very thin and flexible, which makes them suitable for use in curved or flexible displays. 2. OLEDs have a high contrast ratio, and produce images with vivid and rich colours.
3. OLEDs have a fast response time, resulting in smooth and seamless motion in video content.
4. OLEDs have a wide viewing angle, and image quality is maintained even when viewed from different angles.
5. OLEDs are energy efficient, as they do not require a backlight like traditional LCD displays.

1

Applications:

1. QLED displays are commonly used in televisions, monitors, smartphones, and other electronic devices
2. QLEDs can also be used as a source of lighting in various applications, including automotive lighting, street lighting, and architectural lighting.
3. QLEDs can be used in medical imaging applications, such as in MRI machines, to produce high-resolution and accurate images.
4. QLED displays can be used in advertising displays, such as digital billboards and signage, to produce high-quality and eye-catching visuals.

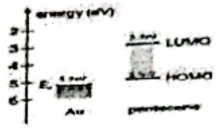
1

2(C)	**Explain** working of organic memory devices by taking p-type and n-type organic semiconductor materials.	5
	a. The p-Type Organic Semiconductor Material "Pentacene" An Organic molecule with a conjugated JI system and possess holes as major charge carrier is called p-type semiconductor.	

Example: Pentacene

When a positive voltage was applied between gate and source, it was found no flow of electrons to drain due to higher energy gap between the Fermi level of gold (source) and LUMO of Pentacene. On the other hand, when a negative voltage is applied between the drain and source, holes are induced at source. This permits a channel of charges (holes) to drain through semiconductor and insulator interface when a secondary voltage is applied. Therefore it called as P-type semiconductor

3

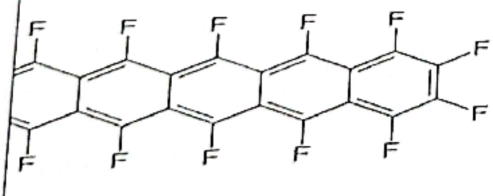


b. **The n-type organic semiconducting material Perfluoropentacene**

An Organic molecule with a conjugated system with electron withdrawing substituent groups and possess electrons as major charge carrier is called n-type semiconductor.

In Pentacene, when hydrogen atoms are substituted by highly electronegative fluorine atoms, it is called Perfluoropentacene and acts as N-type of semiconductor. When a positive voltage is applied between source and drain, electrons are induced in the source (gold). This permits the channel of charges to drain through semiconductor-insulator interface as the bandgap between Fermi levels of gold (source) LUMO energy of Perfluoropentacene is 1.95ev which is lesser than LUMO energy of Pentacene. Therefore, it is n-type semiconductor.

2



PART-B

3(a)	**Utilizing** the metal extraction technique, **illustrate** the extraction of gold from e-waste.	5
Sol	**Extraction of gold from e-waste :** **Principle:** The principle behind the extraction of gold from e-waste is based on the fact that gold is a relatively non-reactive metal, which	

allows it to be recovered from complex electronic waste matrices through a series of chemical and physical processes. Experimental procedure:

1. **Collection and segregation of e-waste:** The first step involves collecting and segregating the e-waste into different categories, such as computer motherboards, cell phones, and other electronic devices. 1

2. **Physical separation:** The e-waste is physically separated into different components, such as plastics, metals, and glass.

3. **Leaching:** The metals, including gold, are leached from the e-waste using a suitable reagent, such as aqua regia (a mixture of hydrochloric acid and nitric acid), to dissolve the gold.

$$Au + HNO_3 + 4HCl \rightarrow HAuCl_4 + NO + 2H_2O$$

4. **Precipitation:** The dissolved gold is then precipitated out of the solution through the

addition of a suitable reducing agent, such as sodium metabisulfite. 2

$$2H[AuCl_4] + 3Na_2S_2O_5 + 3H_2O \rightarrow 2Au + 3SO_2 + 3Na_2SO_4 + 8HCl$$

5.**Purification:**

The precipitated gold is then purified through processes such as ion exchange, electrowinning, or distillation, to remove impurities and improve its quality.

6.**Metal Recovery Stage:**

In this stage Gold metal can be recovered from the obtained complex using methods like Electrodeposition, Solvent – Extraction, Ion – Exchange, Precipitation, etc.,

Ex: - Electrodeposition:-

In this method pure gold metal taken as cathode and inert anode are dipped in obtained leached complex solution. When current is applied gold is electrodeposited on cathode. 2

3(b)	**Explain** the role of stakeholders in terms of producers, consumers, recyclers, and statutory bodies in the e-waste management.	5

Role of stakeholders - producers, consumers, recyclers, and statutory bodies.

In the management of electronic waste (e-waste), the following stakeholders play important unique role in the management of e-waste:

Sol

1. **Producers** - are responsible for designing and producing electronic products and may also be involved in the collection and recycling of e-waste.
2. **Consumers** - play a crucial role in the responsible disposal of e-waste and making informed choices about the purchase of electronic products.
3. **Recyclers** - are responsible for safely and responsibly managing e-waste, including the collection, dismantling, and recycling of electronic waste.

Statutory bodies - such as governments, are responsible for creating and enforcing regulations and policies to manage e-waste and promoting public awareness and education about e-waste management.

4(a)	Applying pyrometallurgical and hydrometallurgical technique, **illustrate** the recycling of e-waste.	5

Sol

Hydrometallurgical extraction of E waste: E-waste hydrometallurgical extraction is a process used to extract valuable metals and other materials from electronic waste through chemical reactions in aqueous solutions. The process typically involves the following steps: 2

1. Pre-treatment: This involves the fragmentation and size reduction of electronic waste to prepare it for further processing.
2. Leaching: The e-waste is treated with chemical reagents in a solution to dissolve the metals and other materials, creating a leachate.
3. Separation: The leachate is then processed to separate and purify the metals and other materials, through methods such as precipitation or ion exchange.
4. Recovery: The extracted metals and other materials are then recovered and processed for reuse. Hydrometallurgical extraction is a more environmentally friendly alternative to thermal treatments, as it generates less hazardous waste and can be more easily regulated to minimize environmental impact.
5. Recovery: The extracted metals and other materials are then recovered and processed for reuse.

Hydrometallurgical extraction is a more environmentally friendly alternative to thermal treatments, as it generates less hazardous waste and can be more easily regulated to minimize environmental impact.

Pyrometallurgical methods E-waste recycling:

E-waste pyrometallurgical methods refer to the process of extracting valuable metals and other materials from electronic waste using high temperatures. These methods include: 3

1. Smelting: The e-waste is melted in a furnace and then separated into individual metals and other materials.

	2. Refining: The metals from the smelted e-waste are further processed to remove impurities and improve their quality. 3. Incineration: Electronic waste is burned at high temperatures to reduce its volume and recover metals. 4. Pyrometallurgical methods are effective at recovering valuable metals from e-waste, but they also generate hazardous byproducts and require significant energy inputs. Additionally, these methods can pose a risk to the environment and human health if not properly regulated and monitored	
4(b)	**Explain** sources and composition of e-waste.	5
Sol	**Source of E- Waste :** 1. Electronic devices: such as TV's, computer monitors, laptops and display devices. 2. Telecommunication devices: such as cellphones, calculators, audio and video devices, printers' canners', fax machines etc..... 3. Electronic components: such as sensors, alarms, sirens, security devices automobile electronic devices. 4. Kitchen equipment's (coffee makers, microwave ovens, refrigerator,) 5. Laboratory equipment's (Hot plates, microscopes, microwave ovens) 6. Medical equipment such as X-ray machines, monitors, and diagnostic equipment. **Composition of E-Waste ;** 1. The composition of electronic waste (e-waste) can vary depending on the type of device and its components. In general, e-waste contains a mixture of materials including: 2. Metals: E-waste often contains valuable metals such as copper, gold, silver, and aluminium, ferrous metal, lead, mercury, Lithium, Nickle. 3. Plastics: Many electronic devices contain plastic components, including casings, insulation, and cables. 4. Glass: Electronic devices often contain glass components, such as screens and lenses. 5. Circuit boards: Many electronic devices contain circuit boards, which contain a mixture of metals and other materials. 6. Batteries: Some electronic devices contain batteries, which can contain hazardous materials such as lead, mercury, and cadmium. 7. Other hazardous materials: E-waste may also contain other hazardous materials, such as flame retardants, heavy metals, and polychlorinated biphenyls (PCBs).	3 2

Course In charge

Head of the Department
Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management

Principal
Dr. K. RAMA NARASIMHA
Principal/Director
K S School of Engineering and Manage
Bangalore - 560 10

Visvesvaraya Technological University, Belagavi

Model Question Paper-1 with effect from 2022

Computer Science & Engg. Stream (CBCS Scheme)

First /Second Semester Engineering Degree Examination

USN: | | | | | | | | | | |

Subject Title: Chemistry for Computer Science & Engineering Stream 22CHES12/22

TIME: 03 Hours

Max. Marks: 100

Note: Answer FIVE full questions, choosing one full question from each module

			Marks
		MODULE 1	
1	a	Explain the working principle of Conductometric sensors (conductometry), and Optical sensors (colorimetry)	7
	b	What are Electrochemical Sensors? Explain its application in the measurement of Dissolved Oxygen (DO)	7
	c	Describe the construction, working and applications of Lithium-ion batteries and mention any four applications	6
		OR	
2	a	Explain the working principle of Electrochemical sensors, and mention its applications	6
	b	Describe the application of Electrochemical gas sensors in sensing SOx and NOx	7
	c	What are Quantum Dot Sensitized Solar Cells (QDSSC's)? Explain the working Principle, Properties and Applications.	7
		MODULE 2	
3	a	Explain the types of organic memory devices by taking p-type and n-type semiconductor materials	7
	b	What are photoactive and electroactive materials and explain their working principle in display system	6
	c	What are nanomaterials? Explain any four properties of Polythiophenes (P3HT) suitable for optoelectronic devices.	7
		OR	
4	a	What are Memory Devices? Explain the Classification of electronic memory devices with examples	6
	b	Mention any four properties and applications of LC-displays	7
	c	Mention any four properties and applications of QLED	7
		MODULE 3	
5	a	Define metallic corrosion? Describe the electrochemical theory of corrosion taking iron as an example.	7
	b	Explain: (i) Differential metal corrosion & (ii) Water-line corrosion	6
	c	Describe galvanizing and mention its applications.	7
		OR	
6	a	Explain: i) corrosion control by Anodization & ii) Sacrificial anodic method.	6
	b	Explain the construction and working of Calomel electrode	7
	c	What is CPR? A thick brass sheet of area 400 $inch^2$ is exposed to moist air. After 2 years of period, it was found to experience a weight loss 375 g due to corrosion. If the density of brass is 8.73 g/cm^3. Calculate CPR in mpy and mmpy.	7

		MODULE 4	
7	a	A polydisperse sample of polystyrene is prepared by mixing three monodisperse samples in the following proportions. 1g of 10000 molecular weight, 2g of 50000 molecular weight and 2g of 100000 molecular weight. Determine number average and weight average molecular weight. Find the index of polydispersity.	7
	b	Explain the synthesis of Polyacetylene and mention its applications	7
	c	Explain the generation of hydrogen by Alkaline water electrolysis	6
		OR	
8	a	Describe the hydrogen production by photo catalytic water splitting method.	7
	b	Preparation, properties, and commercial applications of Kevlar.	7
	c	Explain the construction and working of photovoltaic cells.	6
		MODULE 5	
9	a	Mention the sources of e-waste and explain the need for e-waste management	7
	b	Explain the recycling of e-waste	7
	c	Explain the extraction of gold from e-waste	6
		OR	
10	a	Explain the ill effects of toxic materials used in manufacturing electrical and electronic products	7
	b	Explain the pyrometallurgical and direct recycling methods.	6
	c	Write a brief note on role of stakeholders for example; producers, consumers, recyclers, and statutory bodies.	7

Visvesvaraya Technological University, Belagavi

Model Question Paper-2 with effect from 2022

Computer Science & Engg. Stream (CBCS Scheme)

First /Second Semester Engineering Degree Examination

USN: | | | | | | | | | | |

Subject Title: Chemistry for computer science & Engineering stream 22CHES12/22

TIME: 03 Hours

Max. Marks: 100

Note:Answer FIVE full questions, choosing one full question from each module

		MODULE 1	Marks
1	a	Explain the working principle of potentiometry sensors , and Thermal sensors (Flame photometer)	7
	b	Write a note on Disposable Sensors? Explain its advantages over classical sensors	7
	c	Describe the construction, working and applications of Sodium-ion batteries and mention any four applications	6
		OR	
2	a	Explain the working principle of Electrochemical sensors, and mention its applications	6
	b	What are Actuators & Transducers?Explain about detection of Glyphosate with electrochemical oxidation.	7
	c	What are batteries? Explain the working Principle, Properties and Applications of Quantum Dot sensitized solar cells.	7
		MODULE 2	
3	a	Explain the types of organic memory devices by taking p-type and n-type semiconductor materials	7
	b	What are Memory Devices? Explain the Classification of electronic memory devices with examples	6
	c	What are nanomaterials? Explain any four properties of Poly[9-vinylcarbazole] (PVK) suitable for optoelectronic devices.	7
		OR	
4	a	Explain the types of organic memory devices by taking p-type and n-type semiconductor materials	6
	b	Mention any four properties and applications of LCD-displays	7
	c	Mention any four properties and applications of OLED	7
		MODULE 3	
5	a	Define corrosion? Mention at least six implications of corrosion .	7
	b	Explain: (i) Differential metal corrosion & (ii) Water-line corrosion	6
	c	Explain the construction and working of glass electrode	7
		OR	

6	a	Explain the application of conductometric electrode in estimation of weak acid.	
	b	Explain: i) corrosion control by Anodization & ii) Sacrificial anodic method.	7
	c	What is CPR? A thick brass sheet of area 100 inch² is exposed to moist air. After 1 years of period, it was found to experience a weight loss 75 g due to corrosion. If the density of brass is 2.52 g/cm³. Calculate CPR in mpy and mmpy.	7
		MODULE 4	
7	a	A polydisperse sample of polystyrene is prepared by mixing three monodisperse samples in the following proportions. 1g of 10000 molecular weight, 2g of 50000 molecular weight and 2g of 100000 molecular weight. Determine number average and weight average molecular weight. Find the index of polydispersity.	7
	b	Explain the Preparation, properties, and commercial applications of Kevlar.	7
	c	Describe the hydrogen production by photo catalytic water splitting method.	6
		OR	
8	a	Describe the hydrogen production by photo catalytic water splitting method.	7
	b	Mention the properties of hydrogen pertaining to fuel and its advantages in production of energy.	7
	c	What are green fuels?Explain the advantages & disadvantages of photovoltaic cells.	6
		MODULE 5	
9	a	What are e-waste and explain the need for e-waste management	7
	b	Explain the health hazard due to exposure to e-waste.	7
	c	Write a brief note on role of stakeholders for example; producers, consumers, recyclers, and statutory bodies.	6
		OR	
10	a	Which all toxic materials used in manufacturing electrical and electronic products, write there effects on environment.	7
	b	Explain the advantages of recycling and recovery in e-wastes.	6
	c	Explain about sorces, composition and characteristics of e-waste.	7

Visvesvaraya Technological University, Belagavi.

Model Question Paper for Chemistry for

Computer Science and Engineering and allied branches (CSE/ISE and BT)
(Chemistry group)

First/Second Semester B.E. Degree Examination
Engineering Chemistry (21CHE12/22)

Time	**3Hr**	**Note: Answer FIVE full questions, choosing one full question from each module**	**Max. Marks** / **Blooms Level**	**Course outcomes**	**100** / **Marks**
MODULE 1					
1	a	Explain the working principle of Conductometric sensors (conductometry), and Optical sensors (colorimetry)	L1, L2	CO1	7
	b	What are Electrochemical Sensors? Explain its application in the measurement of Dissolved Oxygen (DO)	L3	CO2	7
	c	Describe the construction, working and applications of Lithium-ion batteries and mention any four applications	L4	CO3	6
OR					
2	a	Explain the working principle of Electrochemical sensors, and mention its applications	L3	CO4	6
	b	Describe the application of Electrochemical gas sensors in sensing SOx and NOx	L3	CO5	7
	c	What are Quantum Dot Sensitized Solar Cells (QDSSC's)? Explain the working Principle, Properties and Applications.	L2	CO3	7
MODULE 2					
3	a	Explain the types of organic memory devices by taking p-type and n-type semiconductor materials	L2	CO2	7
	b	What are photoactive and electroactive materials and explain their working principle in display system	L2	CO2	6
	c	What are nanomaterials? Explain any four properties of Polythiophenes (P3HT) suitable for optoelectronic devices.	L2	CO4	7
OR					
4	a	What are Memory Devices? Explain the Classification of electronic memory devices with examples	L1	CO2	6
	b	Mention any four properties and applications of LC-displays	L2	CO3	7
	c	Mention any four properties and applications of QLED	L2	CO3	7
MODULE 3					
5	a	Define metallic corrosion? Describe the electrochemical theory of corrosion taking iron as an example.	L3	CO2	7
	b	Explain: (i) Differential metal corrosion & (ii) Water-line corrosion	L2	CO2	6
	c	Describe galvanizing and mention its applications.	L2	CO3	7
OR					

6	a	What is meant by metal finishing? Mention (any five) technological importance of metal finishing.	L2	CO1	6
	b	Explain the construction and working of Calomel electrode	L2	CO2	7
	c	What is CPR? A thick brass sheet of area 400 inch^2 is exposed to moist air. After 2 years of period, it was found to experience a weight loss 375 g due to corrosion. If the density of brass is 8.73 g/cm^3. Calculate CPR in mpy and mmpy.	L3	CO4	7
MODULE 4					
7	a	A polydisperse sample of polystyrene is prepared by mixing three monodisperse samples in the following proportions. 1g of 10000 molecular weight, 2g of 50000 molecular weight and 2g of 100000 molecular weight. Determine number average and weight average molecular weight. Find the index of polydispersity.	L3	CO4	7
	b	Explain the synthesis of Polyacetylene and mention its applications	L2	CO2	7
	c	Explain the generation of hydrogen by Alkaline water electrolysis	L2	CO3	6
OR					
8	a	Describe the hydrogen production by photo catalytic water splitting method.	L2	CO2	7
	b	Preparation, properties, and commercial applications of graphene oxide.	L2	CO2	7
	c	Explain the construction and working of photovoltaic cells.	L2	CO2	6
MODULE 5					
9	a	Mention the sources of e-waste and explain the need for e-waste management	L2	CO1	7
	b	Explain the recycling of e-waste	L2	CO2	7
	c	Explain the extraction of gold from e-waste	L2	CO3	6
OR					
10	a	Explain the ill effects of toxic materials used in manufacturing electrical and electronic products	L2	CO1	7
	b	Explain the pyrometallurgical and direct recycling methods.	L2	CO2	6
	c	Write a brief note on role of stakeholders for example; producers, consumers, recyclers, and statutory bodies.	L2	CO1	7

CBCS SCHEME

USN | | | | | | | | | | |

BCHES102

First Semester B.E./B.Tech. Degree Examination, Jan./Feb. 2023
Applied Chemistry for CSE Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

			M	L	C
		Module – 1			
Q.1	a.	What are batteries? Explain the working principle, properties and applications of quantum Dot sensitized solar cells.	7	L2	CO1
	b.	Explain the working principle of electrochemical sensors, and mention its applications.	6	L2	CO1
	c.	What are sensors? Explain the detection of ascorbic Acid and Glyphosate using sensors.	7	L2	CO1
		OR			
Q.2	a.	What are electro chemical sensors? Explain its applications in the measurement of dissolved oxygen (DO).	7	L2	CO1
	b.	Describe the construction working and applications of Lithium – ion batteries and mention any four applications.	6	L2	CO1
	c.	Explain about detection of Diclofenac and hydro carbons (PAH's) with electro chemical oxidation sensors.	7	L2	CO1
		Module – 2			
Q.3	a.	What are photoactive and electro active materials and explain their working principle in display system.	6	L2	CO1
	b.	Explain any four properties and applications of light emitting materials – poly [9 – Vinyl Carbazole] (PVK) suitable for opto electronic devices.	6	L2	CO1
	c.	Discuss the working and liquid crystal display.	8	L2	CO1
		OR			
Q.4	a.	Explain the types of organic memory devices by taking P-type and n-type semi conducting materials.	6	L2	CO1
	b.	What are nano materials? Explain any four properties and applications of polythiophenes (P3HT) suitable for optoelectronic devices.	7	L2	CO1
	c.	What is QLED? Mention any four properties and applications of QLED.	6	L2	CO1
		Module – 3			
Q.5	a.	Define metallic corrosion. Describe the electrochemical theory of corrosion taking iron as an example.	6	L2	CO2
	b.	What are Ion-selective electrodes? Explain the determination of pH of a solution using glass electrode.	7	L2	CO2
	c.	Define concentration cell. The EMF of the cell $Ag/AgNO_3(C_1M)//AgNO_3(0.2M)/Ag$ is 0.8V at 25°C. Find the value of C_1.	7	L3	CO2

		OR			
Q.6	a.	Briefly explain the principle, instrumentation and working of potentiometry taking estimation of Iron as example.	6	L2	CO1
	b.	What are reference electrode? Explain the construction, working and application of Calomel electrode.	7	L2	CO1
	c.	What is CPR? A piece of corroded steel plate was found in a submerged ocean vessel. It was estimated that the original area of the plate was 10 inch^2 and that approx 2.6kg had corroded away during the submersion. Assuming a corrosion penetration rate of 200 mpy for this alloy in sea water, estimate the time of submersion in years. The density of steel is 7.9g/cm^3.	7	L3	CO2
		Module – 4			
Q.7	a.	In sample of a polymer, 20% molecules have molecular mass 15000 g/mol, 45% molecules have molecular mass 25000 g/mol, and remaining molecules have molecular mass 27000g/mol, calculate the number average and weight average molecular mass of the polymer.	6	L3	CO3
	b.	Explain the preparation, properties and commercial application of Kevlar.	7	L2	CO3
	c.	What are green fuels? Explain the generation of hydrogen by Alkaline water electrolysis with its advantages.	7	L2	CO3
		OR			
Q.8	a.	Explain the construction and working of photovoltaic cells. Mention the advantages and disadvantages.	6	L2	CO4
	b.	Explain the preparation, properties, and commercial applications of graphene oxide.	7	L2	CO4
	c.	What are conducting polymer? Discuss the conduction mechanism in polyacetylene through oxidative doping technique and its uses.	7	L2	CO4
		Module – 5			
Q.9	a.	Explain the ill effects of toxic materials used in manufacturing electrical and electronic products.	7	L2	CO5
	b.	Write a brief note on role of stake-holders for example, producers, consumers, recyclers and statutory bodies.	6	L2	CO5
	c.	Briefly discuss the various chemical methods involved in hydrometallurgy process of recovery of E-waste.	7	L2	CO5
		OR			
Q.10	a.	Explain the pyro metallurgical recycling methods.	7	L2	CO5
	b.	Explain the steps involved in extraction of gold from e-waste.	7	L2	CO5
	c.	Mention the sources of e-waste and explain the need for e-waste management.	6	L2	CO5

CBCS SCHEME

USN 1KG21CS015

21CHE12/22

First/Second Semester B.E. Degree Examination, Jan./Feb. 2023
Engineering Chemistry

Time: 3 hrs. Max. Marks: 100

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. What is electrode potential? Derive Nernst equation for single electrode potential. (07 Marks)
b. Explain construction, working and applications of glass electrode. (07 Marks)
c. Explain the classification of batteries with suitable examples. (06 Marks)

OR

2 a. Discuss the construction, working and applications of Li – ion battery. (07 Marks)
b. Explain Recycling of Li – ion battery by direct cycling method. (07 Marks)
c. An electrochemical cell consists of a copper electrode dipped in 0.5m $CuSO_4$ and silver electrode dipped in 0.25m $AgNO_3$ solution. Write the cell scheme, cell reaction. Also calculate the emf. (Standard electrode potential of Cu and Ag are 0.34 and 0.80V respectively). (06 Marks)

Module-2

3 a. Explain electrochemical theory of a corrosion by taking Fe as an example. (07 Marks)
b. What is cathodic protection? Discuss sacrificial anodic method. (07 Marks)
c. Discuss electroplating of chromium with applications. (06 Marks)

OR

4 a. Define electroless plating. Discuss electroless plating of copper. (07 Marks)
b. What is metal finishing? Mention any 5 technological importance. (07 Marks)
c. Explain the influence of following factors on corrosion rate :
i) Ratio of anodic to cathodic area
ii) Nature of corrosion product
iii) pH. (06 Marks)

Module-3

5 a. Explain the synthesis and applications of polyurethane. (07 Marks)
b. What are biodegradable polymer? Explain the synthesis and applications of polylactic acid. (07 Marks)
c. Give the properties and applications of carbon nanotubes. (06 Marks)

OR

6 a. Explain synthesis of nanomaterials by Sol-Gel method. (07 Marks)
b. What are conducting polymers? Explain the mechanism of conduction in polyaniline. (07 Marks)
c. What are polymer composites? Explain the synthesis and properties of Kevlar Fiber. (06 Marks)

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-4

7 a. Explain any six basic principle of green chemistry. **(07 Marks)**
b. Explain the synthesis of Adipic acid from benzene and green synthesis from glucose. **(07 Marks)**
c. Discuss the construction and working of photovoltaic cell. **(06 Marks)**

OR

8 a. Explain the construction and working of methanol-oxygen fuel cell. **(07 Marks)**
b. Briefly explain the impacts of oxides of nitrogen and oxides of sulphur on environment. **(07 Marks)**
c. Write short notes on microwave synthesis and bio catalyzed reaction with examples. **(06 Marks)**

Module-5

9 a. What is hard water? Explain the determination of hardness using EDTA titration. **(07 Marks)**
b. In a COD test, 28.1 and 14.0 cm^3 of 0.05N FAS (Ferrous Ammonium Sulphate) solution was required for blank and sample titration respectively. The volume of test sample taken was $25 cm^3$. Calculate the COD of the sample. **(07 Marks)**
c. Explain conductometric titration method for the determination of mixture of strong acid and weak acid with strong base. **(06 Marks)**

OR

10 a. Explain the principle and instrumentation of colorimetry. **(07 Marks)**
b. Define the terms normality, molarity and molality. **(07 Marks)**
c. Define primary and secondary standard solutions, explain briefly the requirement of primary standard solution. **(06 Marks)**

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CBCS SCHEME

USN

BCHES102

First Semester B.E./B.Tech. Degree Examination, Jan./Feb. 2023
Applied Chemistry for CSE Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

			M	L	C
		Module – 1			
Q.1	a.	What are batteries? Explain the working principle, properties and applications of quantum Dot sensitized solar cells.	7	L2	CO1
	b.	Explain the working principle of electrochemical sensors, and mention its applications.	6	L2	CO1
	c.	What are sensors? Explain the detection of ascorbic Acid and Glyphosate using sensors.	7	L2	CO1
		OR			
Q.2	a.	What are electro chemical sensors? Explain its applications in the measurement of dissolved oxygen (DO).	7	L2	CO1
	b.	Describe the construction working and applications of Lithium – ion batteries and mention any four applications.	6	L2	CO1
	c.	Explain about detection of Diclofenac and hydro carbons (PAH's) with electro chemical oxidation sensors.	7	L2	CO1
		Module – 2			
Q.3	a.	What are photoactive and electro active materials and explain their working principle in display system.	6	L2	CO1
	b.	Explain any four properties and applications of light emitting materials – poly [9 – Vinyl Carbazole] (PVK) suitable for opto electronic devices.	6	L2	CO1
	c.	Discuss the working and liquid crystal display.	8	L2	CO1
		OR			
Q.4	a.	Explain the types of organic memory devices by taking P-type and n-type semi conducting materials.	6	L2	CO1
	b.	What are nano materials? Explain any four properties and applications of polythiophenes (P3HT) suitable for optoelectronic devices.	7	L2	CO1
	c.	What is QLED? Mention any four properties and applications of QLED.	6	L2	CO1
		Module – 3			
Q.5	a.	Define metallic corrosion. Describe the electrochemical theory of corrosion taking iron as an example.	6	L2	CO2
	b.	What are Ion-selective electrodes? Explain the determination of pH of a solution using glass electrode.	7	L2	CO2
	c.	Define concentration cell. The EMF of the cell $Ag/AgNO_3(C_1M)//AgNO_3(0.2M)/Ag$ is 0.8V at 25°C. Find the value of C_1.	7	L3	CO2

		OR			
	a.	Briefly explain the principle, instrumentation and working of potentiometry taking estimation of Iron as example.	6	L2	CO1
	b.	What are reference electrode? Explain the construction, working and application of Calomel electrode.	7	L2	CO1
	c.	What is CPR? A piece of corroded steel plate was found in a submerged ocean vessel. It was estimated that the original area of the plate was 10 inch^2 and that approx 2.6kg had corroded away during the submersion. Assuming a corrosion penetration rate of 200 mpy for this alloy in sea water, estimate the time of submersion in years. The density of steel is 7.9g/cm^3.	7	L3	CO2
		Module – 4			
Q.7	a.	In sample of a polymer, 20% molecules have molecular mass 15000 g/mol. 45% molecules have molecular mass 25000 g/mol, and remaining molecules have molecular mass 27000g/mol, calculate the number average and weight average molecular mass of the polymer.	6	L3	CO3
	b.	Explain the preparation, properties and commercial application of Kevlar.	7	L2	CO3
	c.	What are green fuels? Explain the generation of hydrogen by Alkaline water electrolysis with its advantages.	7	L2	CO3
		OR			
Q.8	a.	Explain the construction and working of photovoltaic cells. Mention the advantages and disadvantages.	6	L2	CO4
	b.	Explain the preparation, properties, and commercial applications of graphene oxide.	7	L2	CO4
	c.	What are conducting polymer? Discuss the conduction mechanism in polyacetylene through oxidative doping technique and its uses.	7	L2	CO4
		Module – 5			
Q.9	a.	Explain the ill effects of toxic materials used in manufacturing electrical and electronic products.	7	L2	CO5
	b.	Write a brief note on role of stake-holders for example, producers, consumers, recyclers and statutory bodies.	6	L2	CO5
	c.	Briefly discuss the various chemical methods involved in hydrometallurgy process of recovery of E-waste.	7	L2	CO5
		OR			
Q.10	a.	Explain the pyro metallurgical recycling methods.	7	L2	CO5
	b.	Explain the steps involved in extraction of gold from e-waste.	7	L2	CO5
	c.	Mention the sources of e-waste and explain the need for e-waste management.	6	L2	CO5

CBCS SCHEME

USN | 4 | G | E | 2 | B | 2 | 8 | 0 | 4 | 4 |

BCHES102/202

First/Second Semester B.E./B.Tech. Degree Examination, June/July 2024

Applied Chemistry for CSE Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

			M	L	C
		Module – 1			
Q.1	a.	What are electrochemical sensors? Explain the principle and working of electrochemical sensor.	07	L1	CO1
	b.	Explain the principle, working and any two applications of optical sensor.	06	L1	CO1
	c.	What is Quantum Dot sensitized solar cell? Explain the construction and working of Quantum Dot sensitized solar cell.	07	L1	CO1
		OR			
Q.2	a.	Explain the detection of bio-molecule ascorbic acid using disposable sensor and also write the electro oxidation reaction.	07	L1	CO1
	b.	Explain the working principle of electrochemical gas sensors for the detection of SO_x and NO_x .	06	L1	CO1
	c.	Explain the construction and working of Li-ion battery. Mention any two applications.	07	L1	CO1
		Module – 2			
Q.3	a.	What are memory devices? Explain the classification of electronic memory devices.	07	L2	CO2
	b.	Define optoelectronic device. Explain the working principle of optoelectronic device.	06	L2	CO2
	c.	What are liquid crystals? Explain the classification of liquid crystals.	07	L2	CO2
		OR			
Q.4	a.	Explain the types of organic memory devices by talking p-type and n-type semiconducting materials.	07	L2	CO2
	b.	Explain any three properties and applications of polythiophene (P3HT) suitable for optoelectronic devices.	06	L2	CO2
	c.	What is QLED? Mention any three properties and applications of QLED.	07	L2	CO2
		Module – 3			
Q.5	a.	Define metallic corrosion. Explain electrochemical theory of corrosion.	07	L3	CO3
	b.	A thick steel sheet of area 400 $inch^2$ is exposed to moist air. After 2 years of period, it was found to experience a weight lost of 375g due to corrosion if the density of steel is 7.9 g/cm^3, calculate CPR in mpy and mmpy.	06	L1	CO3
	c.	What are reference electrodes? Explain the construction, working and applications of calomel electrode.	07	L1	CO3
		OR			
Q.6	a.	What is galvanization? Explain galvanization of Iron. Mention its applications.	07	L1	CO3
	b.	What are concentration cells? Calculate the cell potential of the following cell at 298 K. Ag | $AgNO_3$(0.005M) || $AgNO_3$ (0.5M) | Ag	06	L1	CO3
	c.	Explain the principle and instruction of conductometry taking estimation of weak acid using a strong base as an example.	07	L2	CO3

		Module – 4			
Q.7	a.	In a sample of a polymer 20% molecules have molecular mass 15,000g/mol, 35% molecules have molecular mass 20000g/mol. Calculate the number average and weight average molecular mass of the polymer.	07	L3	CO4
	b.	Explain the preparation of Kevlar. Mention any four applications.	06	L2	CO4
	c.	Explain the generation of hydrogen by Alkaline water electrolysis with a neat labelled diagram.	07	L2	CO4
		OR			
Q.8	a.	What are conducting polymers? Explain the conduction mechanism in polyacetylene through oxidative doping technique. Mention any two applications.	07	L3	CO4
	b.	What are PV cells? Explain the construction and working of photovoltaic cell.	06	L2	CO4
	c.	Explain the generation of hydrogen by proton exchange membrane electrolysis.	07	L2	CO4
		Module – 5			
Q.9	a.	Define E-waste. Explain the sources and composition of E-waste.	07	L2	CO5
	b.	Explain the ill effects of materials used in manufacturing electrical and electronic products.	06	L2	CO5
	c.	Explain pyrometallurgical process of extraction of E-waste.	07	L2	CO5
		OR			
Q.10	a.	Explain the extraction of gold from E-waste.	07	L2	CO5
	b.	Explain direct recycling of E-waste.	06	L2	CO5
	c.	Write a brief note on role of stakeholders for example, producers consumers, recyclers and statutory bodies in management of E-waste.	07	L2	CO5

* * * * *

CBCS SCHEME

USN | 1 | | | | | | | | | |

BCHES102/202

First/Second Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024

Applied Chemistry for CSE Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

			M	L	C
		Module – 1			
Q.1	a.	Explain the working principle of conductometric sensors and mention any two applications.	06	L2	CO2
	b.	Discuss the construction and working of Li-ion batteries. Mention its applications.	07	L2	CO4
	c.	Describe the application of Electrochemical gas sensors for the detection of SO_x and NO_x.	07	L3	CO3
		OR			
Q.2	a.	Explain the working principle of an Electrochemical sensor in the detection of Dissolved Oxygen (DO).	06	L2	CO2
	b.	Discuss the construction and working of Quantum Dot Sensitized Solar Cells (QDSSCs). Mention its applications.	07	L2	CO4
	c.	Describe the use of disposable sensor in the detection of herbicide Glyphosate.	07	L3	CO3
		Module – 2			
Q.3	a.	What are memory devices? Explain the classification of Electronic memory devices with examples.	07	L1 L2	CO1
	b.	What are nanomaterials? Explain any four properties of polythiophenes (P_3HT) suitable for optoelectronic devices.	07	L1 L2	CO1 CO4
	c.	Mention any three properties and applications of QLED.	06	L1	CO4
		OR			
Q.4	a.	Explain the types of organic memory. Devices by taking p-type and n-type semiconductor materials.	07	L2	CO2
	b.	What are photoactive and electroactive materials and explain their working principle in the display system.	07	L2	CO1 CO2
	c.	Mention any 3 properties and applications of LC-displays.	06	L1	CO4
		Module – 3			
Q.5	a.	Define metallic corrosion. Describe the electrochemical theory of corrosion taking.	07	L1 L2	CO1 CO2
	b.	Describe galvanizing and mention its applications.	06	L2	CO4
	c.	What is CPR? A thick brass sheet of area 400 inches exposed to moist air. After 2 years of period. It was found to experience a weight loss of 375 g due to corrosion. If the density of brass is 8.73 g/cms, calculate CPR in mpy and mmpy.	07	L2	CO1 CO3
		OR			
Q.6	a.	Explain the construction and working of the Calomel electrode.	07	L2	CO2
	b.	Explain the application of conductometric electrodes in the estimation of a weak acid.	06	L2	CO4
	c.	Define concentration cell. Derive an expression for emf of the cell.	07	L1 L2	CO1 CO3

		Module – 4			
Q.7	a.	A polydisperse sample of polystyrene is prepared by mixing three monodisperse samples in the following proportions. 1 g of 10000 molecular weight, 2 g of 50000 mol. wt and 2 g of 100000 mol.wt. Determine the number and weight average mol. wt.	07	L2	CO3
	b.	What is Green fuel (hydrogen fuel)? Mention the advantages of Green fuel.	06	L1	CO1
	c.	Explain the construction and working of Photovoltaic cells.	07	L2	CO2
		OR			
Q.8	a.	Discuss the conduction mechanism in polyacetylene through oxidative or reductive doping techniques (Any one).	07	L3	CO2
	b.	Explain the generation of hydrogen by alkaline water electrolysis.	07	L2	CO4
	c.	Explain the preparation, properties and applications of Kevlar.	06	L2	CO4
		Module – 5			
Q.9	a.	What is e-waste? Explain the need for e-waste management.	07	L2	CO1
	b.	Explain the process of recycling e-waste.	06	L2	CO5
	c.	Discuss the following : (i) Pyrometallurgy (ii) Hydrometallurgy	07	L3	CO5
		OR			
Q.10	a.	Explain the extraction of gold from e-waste.	07	L2	CO2
	b.	Write a brief note on the role of stakeholders for example: Producers, Consumers, Statutory bodies.	07	L3	CO5
	c.	Explain the health hazards due to exposure to e-waste.	06	L2	CO3

*****

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

DEPARTMENT OF APPLIED SCIENCE

SLOW LEARNERS LIST AFTER FIRST IA

Class/ Section: II A

Subject/ Subject code: Applied Chemistry/ BCHES202

Sl.No.	USN	Student Name	Marks	Signature
1	1KG23CS005	AJIT[redacted] KUMAR	11	
2	1KG23CS007	AKHIL GOUTHAM K	3	
3	1KG23CS009	AMRUTHA K	9	
4	1KG23CS010	ANKITHA P	7	
5	1KG23CS016	BHAVYA SAI SHREE V	4	
6	1KG23CS020	CHALLA BALAJI NAIDU	9	
7	1KG23CS022	D JAYA KRISHNA	5	
8	1KG23CS024	DEEKSHA N	11	
9	1KG23CS027	DHEERAJ R	12	
10	1KG23CS046	K BINDU	7	
11	1KG23CS047	K DHEERAJ CHOWDARY	3	
12	1KG23CS049	K P NIHAAL	9	
13	1KG23CS050	K YESHWANTH CHOWDARY	10	
14	1KG23CS055	KOTHA HARSHA NANDHAN	11	
15	1KG23CS063	M NEVARUTH SAI	6	
16	1KG23CS091	S AKSHATHA	12	
17	1KG23CS106	SOURABH GOUD ALLOLLI	10	
18	1KG23CS078	PARSHURAM N	AB	—

Signature of the Staff

HOD AS

Dr. C. VASUDEV

Professor & HOD

Department of Applied Science

K.S. School of Engineering & Manage

Bangalore - 560 109

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BANGALORE - 560109

DEPARTMENT OF APPLIED SCIENCE

ADVANCE LEARNERS LIST AFTER FIRST IA

Class/ Section: II A

Subject/ Subject code: Applied Chemistry/ BCHES202

Sl.No.	USN	Student Name	Marks	Signature
1.	1KG23CS001	A YASHWITHA	17	
2.	1KG23CS003	ADITYA H	16	
3.	1KG23CS004	ADITYA P MASABINAL	13	
4.	1KG23CS006	AKASH S	24	
5.	1KG23CS008	AMAR	13	
6.	1KG23CS011	ANUSHA M N	22	
7.	1KG23CS013	ASHWINI N R	20	
8.	1KG23CS014	BHARATH KUMAR S C	14	
9.	1KG23CS015	BHASKAR S	14	
10.	1KG23CS017	C YUVARAJ	14	
11.	1KG23CS018	CHAITHANYA C GOWDA	16	
12.	1KG23CS019	CHAITHANYA R	16	
13.	1KG23CS021	CHITRA U	22	
14.	1KG23CS023	D YASHWANTH	20	
15.	1KG23CS025	DEEKSHITHA K	24	
16.	1KG23CS029	DIVIT V	18	
17.	1KG23CS030	DYUTHI S	20	
18.	1KG23CS031	G DAEWOO SRI PRASAD	18	
19.	1KG23CS032	GABBURI NARASANNA PALLAVI	23	
20.	1KG23CS033	GADDAMADUGU DINAVYA	25	
21.	1KG23CS035	GANNI NAVEEN RAJ ANUDEEP	15	
22.	1KG23CS036	H VISHNU	15	
23.	1KG23CS037	HARI NARAYANA S	19	
24.	1KG23CS039	HARSHITHA S	17	
25.	1KG23CS040	IMPANA P	15	
26.	1KG23CS041	INCHARA S	14	
27.	1KG23CS042	ISMATH ZEHERA	25	
28.	1KG23CS043	JANHAVI SUDHAKAR THORAT	21	
29.	1KG23CS044	JHANAVI C	21	
30.	1KG23CS048	K G SOUMYA	19	
31.	1KG23CS051	KAMBHAMPATI VEDAVYAS	15	
32.	1KG23CS052	KARANAM VENNELA	21	
33.	1KG23CS054	KIRAN S	12	

34.	1KG23CS056	KUSHAL K R	22	
35.	1KG23CS057	LAKSHMI B	22	Lakshmi.B
36.	1KG23CS058	LALITH ADITHYA M	15	
37.	1KG23CS060	LISHANTH N	13	
38.	1KG23CS062	M HARSHITH PRAMOD	16	
39.	1KG23CS066	MALLIKARJUNA BIRADAR	20	
40.	1KG23CS068	MANOJ KUMAR C	18	
41.	1KG23CS069	MANYA B M	24	
42.	1KG23CS071	MEGHA	18	Megha.
43.	1KG23CS090	RISHMITHA K B	16	
44.	1KG23CS098	SHASHIDHARA S C	14	
45.	1KG23CS112	VAIBHAVI S	18	

Signature of the Staff

HOD AS

Dr. C. VASUDEV
Professor & HOD
Department of Applied Science
K.S. School of Engineering & Management
Bangalore - 560 109

K.S. SCHOOL OF ENGINEERING AND MANAGEMENT

BENGALURU-560109

DEPARTMENT OF APPLIED SCIENCE

SESSION: 2023-2024 (EVEN SEMESTER)

Pedagogical approach-Flipped Class

Class/Section: CSE, 'A'

Subject: Applied Chemistry for CS stream

Subject code: BCHES202

Date: 20/05/2024 & 21/05/2024

Course In charge: Dr. Anitha R.

Flipped class for second semester 'A' section students was conducted on 20.05.24 & 21.05.24. The topics such as, e-waste management-Hydrometallurgical extraction of E waste, Types of organic memory devices, Molecular ordering in liquid crystals and Conductometric sensors were suggested to the students. Students were given access to study materials, an NPTEL link, and appropriate YouTube videos one week prior to the start of class. During the course of the study, students used a black board and presented using Power Point. The inverted class helped students build a deeper understanding of topics and a greater development of independent learning skills.

Document shared:

Soft copy of Module-1 and 5 notes

YouTube links:

https://youtu.be/ur0MdW5rTIc?si=7I146G1J4URE0ts8

https://youtu.be/U3KUJTDPsSE?si=Y-FnH5Ym8AFaVTTe

https://in.hach.com/oxygen/o2

https://youtu.be/hsGHQUrEfss?si=bEwBtBdHg3NojQFP

NPTEL link:

https://youtu.be/_r5rHyMHKEg?si=0mUxmXCAyIjHLBCi

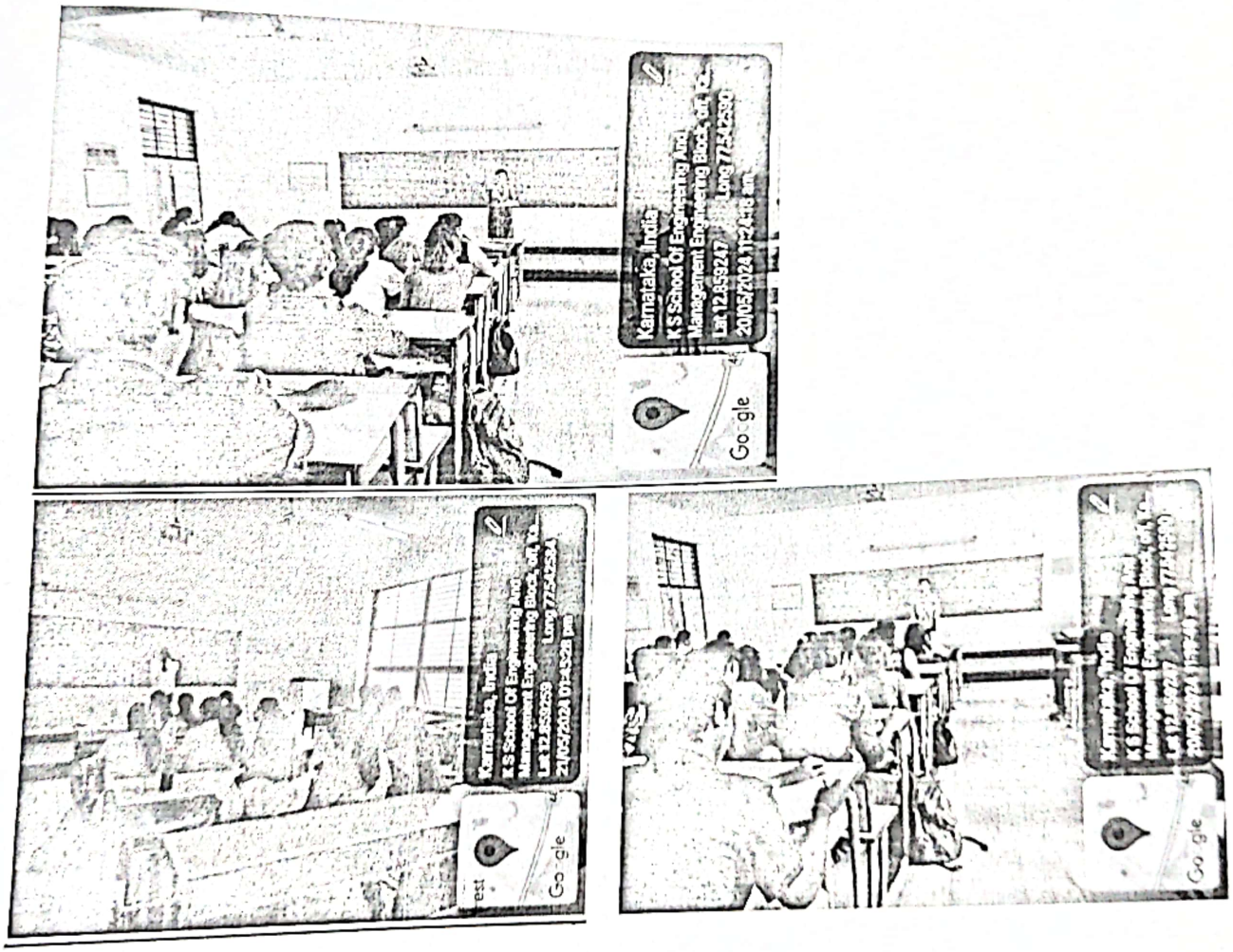
https://youtu.be/kUCVBhSka2Q?si=H9aoy5T6LnyfwUWT

https://youtu.be/mYGfyO3sPxk?si=tC2uyXpaQEwlEFh9

https://youtu.be/I7XLmrpgqEs?si=jX_zANT5K56JWma9

https://youtu.be/d0-LywQVLPM?si=Q7QNqMkIF_P4N0G-

Photograph:



Course In charge

Head of the Department

Dr. C. VASUDEV
Professor & HOD

KSSEM

K. S. SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU-109
DEPARTMENT OF APPLIED SCIENCE
ACADEMIC YEAR: 2023-2024 (Even sem)
Chemistry Cycle – A section

Sl. No.	USN	STUDENTS NAME	IA-1 (25)	IA-2 (25)	IA-3 (25)	IA Average(25) Best of 2(min 10)	IA reduced to 15 (min 6)*0.6	ASGN-1 (10)	ASGN-2 (10)	Asgn Average (10) (min 4)	Final theory IA Test+asgn (15+10)	Lab record (15) min. 6	Lab test (10) min 4	Final lab IA (15+10)	Final IA (50)- Theory+Lab (25+25)	Signature
01	1KG23CS001	A YASHWITHA	17	20	9	19	12	10	10	10	22	15	6	21	43	
02	1KG23CS003	ADITYA H	16	16	15	16	10	10	10	10	20	15	7	22	42	
03	1KG23CS004	ADITYA P MASABINAL	13	13	AB	13	8	10	10	10	18	12	8	20	38	
04	1KG23CS005	AJIT■ KUMAR	11	10	5	11	7	10	10	10	17	8	6	14	31	
05	1KG23CS006	AKASH S	24	23	AB	24	15	10	10	10	25	15	10	25	50	
06	1KG23CS007	AKHIL GOUTHAM K	3	7	12	10	6	10	10	10	16	15	6	21	37	
07	1KG23CS008	AMAR	13	18	14	16	10	10	10	10	20	15	9	24	44	
08	1KG23CS009	AMRUTHA K	9	8	14	11	7	10	10	10	17	15	8	23	40	
09	1KG23CS010	ANKITHA P	7	18	7	13	8	10	10	10	18	6	7	13	31	
10	1KG23CS011	ANUSHA M N	22	23	AB	23	14	10	10	10	24	15	8	23	47	
11	1KG23CS013	ASHWINI N R	20	20	21	21	13	10	10	10	23	15	10	25	48	
12	1KG23CS014	BHARATH KUMAR S	14	10	11	13	8	10	10	10	18	15	8	23	41	
13	1KG23CS015	BHASKAR S	14	20	8	17	11	10	10	10	21	15	9	24	45	
14	1KG23CS016	BHAVYA SAI SHREE	4	20	9	15	9	10	10	10	19	12	9	21	40	
15	1KG23CS017	C YUVARAJ	14	15	AB	15	9	10	10	10	19	12	8	20	39	
16	1KG23CS018	CHAITHANYA C GOWDA	16	24	13	20	12	10	10	10	22	15	9	24	46	
17	1KG23CS019	CHAITHANYA R	16	22	16	19	12	10	10	10	22	15	10	25	47	
18	1KG23CS020	CHALLA BALAJI NAIDU	9	12	5	11	7	10	10	10	17	12	5	17	34	
19	1KG23CS021	CHITRA U	22	25	AB	24	15	10	10	10	25	15	9	24	49	

20	1KG23CS022	D JAYA KRISHNA	5	21	12	17	11	10	10	10	21	15	9	24	45		
21	1KG23CS023	D YASHWANTH	20	24	AB	22	14	10	10	10	24	15	9	24	48		
22	1KG23CS024	DEEKSHA N	11	18	12	15	9	10	10	10	19	15	10	25	44		
23	1KG23CS025	DEEKSHITHA K	24	22	AB	23	14	10	10	10	24	15	10	25	49		
24	1KG23CS027	DHEERAJ R	12	9	11	12	8	10	10	10	18	14	6	20	38		
25	1KG23CS029	DIVIT V	18	16	AB	17	11	10	10	10	21	15	7	22	43		
26	1KG23CS030	DYUTHI S	20	19	16	20	12	10	10	10	22	15	8	23	45		
27	1KG23CS031	G DAEWOO SRI PRASAD	18	15	AB	17	11	10	10	10	21	15	9	24	45		
28	1KG23CS032	GABBURI NARASANNA PALLAVI	23	25	AB	24	15	10	10	10	25	15	10	25	50		
29	1KG23CS033	GADDAMADUGU DINAVYA	25	25	AB	25	15	10	10	10	25	15	10	25	50		
30	1KG23CS035	GANNI NAVEEN RAJ ANUDEEP	15	AB	22	19	12	10	10	10	22	15	7	22	44		
31	1KG23CS036	H VISHNU	15	16	13	16	10	10	10	10	20	15	8	23	43		
32	1KG23CS037	HARI NARAYANA S	19	23	22	23	14	10	10	10	24	15	9	24	48		
33	1KG23CS039	HARSHITHA S	17	22	18	20	12	10	10	10	22	15	9	24	46		
34	1KG23CS040	IMPANA P	15	20	AB	18	11	10	10	10	21	15	6	21	42		
35	1KG23CS041	INCHARA S	14	21	14	18	11	10	10	10	21	15	9	24	45		
36	1KG23CS042	ISMATH ZEHERA	25	25	AB	25	15	10	10	10	25	15	9	24	49		
37	1KG23CS043	JANHAVI SUDHAKAR THORAT	21	23	AB	22	14	10	10	10	24	15	9	24	48		
38	1KG23CS044	JHANAVI C	21	24	AB	23	14	10	10	10	24	15	10	25	49		
39	1KG23CS046	K BINDU	7	6	12	10	6	10	10	10	16	14	5	19	35		
40	1KG23CS047	K DHEERAJ CHOWDARY	3	10	9	10	6	10	10	10	16	13	7	20	36		
41	1KG23CS048	K G SOUMYA	19	25	AB	22	14	10	10	10	24	15	10	25	49		
42	1KG23CS049	K P NIHAAL	9	13	8	11	7	10	10	10	17	7	6	13	30		
43	1KG23CS050	K YESHWANTH CHOWDARY	10	10	AB	10	6	10	10	10	16	12	9	21	37		

44	1KG23CS051	KAMBHAMPATI VEDAVYAS	15	11	16	16	10	10	10	10	20	11	8	19	39	K. Vedavyas
45	1KG23CS052	KARANAM VENNELA	21	24	14	23	14	10	10	10	24	15	9	24	48	
46	1KG23CS054	KIRAN S	12	16	AB	14	9	10	10	10	19	15	9	24	43	
47	1KG23CS055	KOTHA HARSHA NANDHAN	11	15	12	14	9	10	10	10	19	13	9	22	41	
48	1KG23CS056	KUSHAL K R	22	21	19	22	14	10	10	10	24	15	10	25	49	
49	1KG23CS057	LAKSHMI B	22	25	AB	24	15	10	10	10	25	15	10	25	50	
50	1KG23CS058	LALITH ADITHYA M	15	13	AB	14	9	10	10	10	19	14	9	23	42	
51	1KG23CS060	LISHANTH N	13	14	13	14	9	10	10	10	19	12	6	18	37	
52	1KG23CS062	M HARSHITH PRAMOD	16	16	7	16	10	10	10	10	20	15	9	24	44	
53	1KG23CS063	M NEVARUTH SAI	6	AB	13	10	6	10	10	10	18	13	6	19	35	
54	1KG23CS066	MALLIKARJUNA BIRADAR	20	17	AB	19	12	10	10	10	22	15	9	24	46	
55	1KG23CS068	MANOJ KUMAR C	18	21	16	20	12	10	10	10	22	15	8	23	45	
56	1KG23CS069	MANYA B M	24	25	AB	25	15	10	10	10	25	15	10	25	50	
57	1KG23CS071	MEGHA	24	25	0	25	15	10	10	10	25	15	10	25	50	
58	1KG23CS078	PARSHURAM N	AB	AB				P	P							
59	1KG23CS090	RISHMITHA K B	16	19	11	18	11	10	10	10	21	15	9	24	45	
60	1KG23CS091	S AKSHATHA	12	15	8	14	9	10	10	10	19	15	8	23	42	
61	1KG23CS098	SHASHIDHARA S C	14	13	AB	14	9	10	10	10	19	15	9	24	43	
62	1KG23CS106	SOURABH GOUD ALLOLLI	10	13	20	17	11	10	10	10	21	15	9	24	45	
63	1KG23CS112	VAIBHAVI S	18	19	AB	19	12	10	10	10	22	15	9	24	46	

Anitha R.