Electrical & Electronics Engineering and Allied branches(Chemistry group)

CourseTitle:	**Chemistry for Electrical and Electronics Engineering stream**		
CourseCode:	**BCHEE202/202**	CIEMarks	50
Course Type(Theory/Practical/Integrated)	Integrated	SEEMarks	50
		Total Marks	100
TeachingHours/Week(L:T:P:S)[1]	2:2:2:0	Exam Hours	03
TotalHoursofPedagogy	40hoursTheory+10to 12Lab slots	Credits	04

Courseobjectives

- Toenablestudentstoacquireknowledgeonprinciplesofchemistryforengineeringapplications.
- Todevelopanintuitiveunderstandingofchemistrybyemphasizingtherelatedbranchesofengineering.
- Toprovidestudentswithasolidfoundationinanalyticalreasoningrequiredtosolvesocietal problems.

Teaching-LearningProcess

Thesearesamplestrategies,whichteachercanusetoaccelerateattainmentofthevariouscourseoutcomesandmakeTeaching–Learningmoreeffective

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

MODULE1:ChemistryofElectronicMaterials(8hr)

ConductorsandInsulators: Introduction,principlewithexamples.

Semiconductors: Introduction, production of electronic grade silicon-Czochralski process(CZ) andFloatZone(FZ)methods.

Polymers: Introduction,Molecularweight-Numberaverage,Weightaverageandnumericalproblems.Conductingpolymers–synthesisandconductingmechanismofpolyacetylene.Preparation, propertiesandcommercialapplicationsofgrapheneoxide.

PCB: Electroless plating – Introduction, Electroless plating of copper in the manufacture ofdouble-sidedPCB.

Self-learning: Technologicalimportanceofmetalfinishinganddistinctionbetween electroplatingandelectrolessplating.

MODULE2:EnergyConversionandStorage(8hr)

Batteries: Introduction, classification of batteries. Components, construction, working andapplications of modern batteries; Na-ion battery, solid state battery (Li-polymer battery)andflowbattery(Vanadiumredoxflowbattery).

FuelCells:Introduction,construction,workingandapplicationsofmethanol–oxygenand

1.NOTE:Whereverthecontact hoursisnotsufficient,tutorialhourcanbeconvertedto theoryhours

polymerelectrolytemembrane(PEM)fuelcell.

SolarEnergy: Introduction,importanceofsolarPVcell,constructionandworkingofsolarPVcell,advantagesanddisadvantages.

Self-learning: Electrodesforelectrostaticdoublelayercapacitors,pseudocapacitors,and hybridcapacitor.

MODULE3:CorrosionScienceandE-wasteManagement(8hr)

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

E-waste Management: Introduction, sources, types, effects of e-waste on environment andhuman health, methods of disposal, advantages of recycling. Extraction of copper and goldfrome-waste.

Self-learning: RecyclingofPCBandbatterycomponents

MODULE4:NanomaterialsandDisplaySystems(8hr)

Nanomaterials: Introduction, size dependent properties of nanomaterials (Surface area,Catalytic, Conducting), preparation of nanomaterials by sol-gel and co-precipitation methodwithexample.Introduction,propertiesandapplications-Nanofibers,Nanophotonics,Nanosensors.

DisplaySystems:Liquidcrystals(LC's)-Introduction,classification,propertiesandapplication in Liquid Crystal Displays (LCD's). Properties and application of Organic LightEmittingDiodes(OLED's)andQuantumLightemittingdiodes(QLED's).

PerovskiteMaterials: Introduction,propertiesandapplicationsinoptoelectronicdevices.

Self-learning: Properties&electrochemicalapplicationsofcarbonnanotubesandgraphene.

MODULE5:SensorsinAnalyticalTechniques(8hr)

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, workingand applicationsof calomelelectrode.Concentrationcell–Definition,constructionandNumericalproblems.

Sensors: Introduction,workingprincipleandapplicationsofConductometricsensors,Electrochemicalsensors, Thermometricsensors, andOpticalsensors.

AnalyticalTechniques:Introduction,principleandinstrumentationofColorimetricsensors; its application in the estimation of copper, principleandinstrumentationof Potentiometric sensors; principleandinstrumentationof its applicationin the estimation of iron, Conductometric sensors; its application in the estimation of weakacid.

Self-learning:IRandUV-Visiblespectroscopy.

PRACTICALMODULE

A–Demonstration(anytwo)offline/virtual:

A1.Synthesisofpolyurethane

A2. Determination of strength of an acid in Pb-acid batteryA3.Synthesisofironoxidenanoparticles

A4.Electroplatingofcopperonmetallicobjects

B–Exercise(compulsorilyany4tobeconducted):

B1.Conductometricestimationofacidmixture

B2.PotentiometricestimationofFASusing$K_2Cr_2O_7$

B3.DeterminationofpKaofvinegarusingpHsensor(Glasselectrode)

B4.Determinationofrateofcorrosionofmildsteelbyweightlossmethod B5.Estimation oftotalhardnessofwaterbyEDTAmethod

C–StructuredEnquiry (compulsorilyany4tobeconducted):

C1. Estimation of Copper present in electroplating effluent by optical sensor (colorimetry) C2.DeterminationofViscositycoefficientoflubricant(Ostwald'sviscometer)

C3. Estimation of iron in TMT bar by diphenyl amine/external indicator methodC4.EstimationofSodiumpresentinsoil/effluentsampleusingflamephotometr y

C5.DeterminationofChemicalOxygenDemand(COD)ofindustrialwastewatersample

D–OpenEndedExperiments(anytwo):

D1. Estimation of metal in e-waste by optical sensorsD2.Electroless platingofNickleonCopper

D3.Determinationofglucosebyelectrochemicalsensors

D4.Synthesisofpolyanilineanditsconductivitymeasurement

Courseoutcome(CourseSkillSet)

Attheendofthecourse thestudentwillbeableto:

CO1.	Identify the terms processes involved in scientific and engineering andapplications
CO2.	Explainthephenomenaofchemistrytodescribethemethodsofengineering processes
CO3.	Solvetheproblemsinchemistrythatarepertinentinengineeringapplications
CO4.	Applythebasicconceptsofchemistrytoexplainthechemicalpropertiesandprocesses
CO5.	Analyzepropertiesandmulti processes associated withchemical substances in disciplinarysituations

AssessmentDetails(bothCIEandSEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. 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). Astudentshallbedeemedtohavesatisfiedtheacademicrequirementsandearnedthecreditsallotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in thesemester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total oftheCIE(ContinuousInternalEvaluation)andSEE(SemesterEndExamination)takentogether.

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.Grour Krishana,VikasPublishing
7. ATextbookofEngineeringChemistry,SSDara&Dr.SSUmare,SChand&CompanyLtd.,12th Edition,2011.
8. ATextBookofEngineeringChemistry,R.V.GadagandNityanandaShetty,I.K.InternationalPublishinghouse. 2nd Edition,2016.
9. TextBookofPolymerScience,F.W.Billmeyer,JohnWiley&Sons,4th Edition,1999.
10. NanotechnologyAChemicalApproachtoNanomaterials,G.A.Ozin &A.C.Arsenault,RSCPublishing,2005.
11. CorrosionEngineering,M.G.Fontana,N.D.Greene,McGrawHillPublications,NewYork,3rd Edition,1996.
12. Linden'sHandbookofBatteries,KirbyW.Beard,FifthEdition,McGrawHill,2019.
13. OLEDDisplayFundamentalsandApplications,TakatoshiTsujimura,Wiley–Blackwell,2012
14. Supercapacitors: Materials, Systems, and Applications, Max Lu, Francois Beguin,ElzbietaFrackowiak,Wiley-VCH;1st edition,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. Instrumental Methods of Analysis, Dr. K. R. Mahadik andDr. L. Sathiyanarayanan,NiraliPrakashan,2020
20. PrinciplesofInstrumentalAnalysis,DouglasA.Skoog,F.JamesHoller, StanleyR.CrouchSeventhEdition,CengageLearning, 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,3rdEdition 2014
25. Principlesofnanotechnology,Phanikumar,Scitechpublications,2ndEdition,2010.
26. Chemistryfor EngineeringStudents,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-9IbHrDMjHWWh
- 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

ActivityBasedLearning(SuggestedActivitiesinClass)/PracticalBasedlearning

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

COsandPOsMapping(Individualteacherhastofillup)

	PO											
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**1**	**1**				**1**					
CO2	**3**	**1**	**1**				**1**					
CO3	**3**	**1**	**1**				**1**					
CO4	**3**	**1**	**1**				**1**					
CO5	**3**	**1**	**1**				**1**					

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