

**JAYARAJ ANNAPACKIAM COLLEGE
FOR WOMEN (AUTONOMOUS)**

A Unit of the Sisters of St. Anne of Tiruchirappalli

Accredited with 'A+' Grade (Cycle 4) by NAAC

DST FIST Supported College

**Affiliated to Mother Teresa Women's University,
Kodaikanal**

**PERIYAKULAM – 625 601, THENI DT.
TAMIL NADU.**



**M.PHIL. CHEMISTRY
2020-2023**

PG AND RESEARCH DEPARTMENT OF CHEMISTRY

M. PHIL

PROGRAMME OUTCOMES

PO. NO.	UPON COMPLETION OF THIS PROGRAMME THE STUDENTS WILL BE ABLE TO
1.	Reflect critically on their own, with their peers' and synthetic working situations in the light of new concepts and course input.
2.	Identify relevant sources, evaluate them and to use these appropriately in their studies.
3.	Engage in independent study and group/pair work including the presentation of materials.
4.	Relate skills with self management and task achievement, meeting deadlines, problem-solving and metacognitive awareness.
5.	Associate study skill with data collection and researching, digesting, selecting, planning, writing and presenting articles for publication.
6.	Present reports on their findings in the respective category of work to improve their expertise and imbibe practical abilities.

PROGRAMME SPECIFIC OUTCOMES

PSO. NO.	UPON COMPLETION OF THIS PROGRAMME THE STUDENTS WILL BE ABLE TO	PO MAPPED
1.	Gain in depth knowledge in advances of various aspects of chemistry	PO-1
2.	Assess the mechanisms and theories of organic, inorganic and physical Chemistry	PO-2
3.	Handle the spectral data of compounds for their characterization	PO-4
4.	Analyse the spectro photometric, analytical, electrometric measurements of compounds and Identify the formation and purity of compounds by chromatography	PO-2
5.	Analyse critically the new findings of their research and Formulate the procedure of manuscript and dissertation for their new research findings	PO-5 PO-6

M. Phil. CHEMISTRY-COURSE PATTERN**2020-2023**

Sem	Code	Title of Paper	Hours	Credits
I	20MCH1C01	Research Methodology	10	8
	20MCH1C02	Advances in Chemistry	14	12
	20MCH1E3A/ 20MCH1E3B/ 20MCH1E3C	Indepth study: Metal Complexes and their Applications Indepth study:Nano Chemistry and Photocatalysis Indepth study: Corrosion and its Control methods	6	-
	Total		30	20
II	20MCH2E3A/ 20MCH2E3B/ 20MCH2E3C	Indepth study: Metal Complexes and their Applications Indepth study:Nano Chemistry and Photocatalysis Indepth study: Corrosion and its Control methods	-	5
	20MCH2R01	Project	-	15
	Total		30	40

***In depth study papers are selected by the scholars as per their choice and the dissertation work will be carried out on the basis of their in depth paper**

***Question paper for mid semester and end semester internal examination will be set and valued by the Research advisor only**

***No External Examination for In depth Study Paper**

The components of CIA for the paper on “Indepth study” for the M.Phil. programme are as follows:

PAPER I- RESEARCH METHODOLOGY

Semester: I

Hours: 10

Code : 20MCH1C01

Credits: 8

COURSE OUTCOMES

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO-1	Associate the types and significance of research	PSO-2	K, U
CO-2	Formulate scientific papers and proposals	PSO-5	U, Ap
CO-3	Analyze the data to get information	PSO-3	U, An
CO-4	Develop the skills on separation and purification of chemical compounds	PSO-3	U, An, S
CO-5	Employ the instrumental techniques to carry out the projects	PSO-5	Ap, An

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : I		RESEARCH METHODOLOGY										Hours: 10
Code : 20MCH1C01												Credits: 8
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO1	4	4	3	4	5	4	4	3	4	3	4	3.82
CO2	3	4	3	4	4	5	4	4	4	4	5	4
CO3	4	4	3	4	3	4	3	4	4	5	4	3.82
CO4	3	4	4	5	4	4	4	3	4	4	3	3.82
CO5	4	4	4	3	4	4	4	5	4	5	4	4.09
Overall Mean Score											3.91	

Result: The score for this course is **3.91** (High Relationship)

Note:

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

LITERATURE SURVEY:

Literature survey –sources of information primary- secondary and tertiary resources –chemical journal and journal abbreviations - web publishing- -web resources- Journal access through web-digitized and digital formats-E-journals-e-journals consortium-UGC-INFLIBNET - E-books - Online and digital libraries-useful web links- Search engines Alta vista, google , yahoo search -wikis- scifinder – scopus - scirus - science direct –citation index-impact factor, H-index (30 Hours)

UNIT II

METHODOLOGY OF SCIENTIFIC DOCUMENT WRITING:

Introduction to technical writing –types of report, title and abstract, the text-style and conventions in writing. writing dissertation and thesis-title, abstract, introduction of the thesis, literature review, experimental methods, results and discussion, foot notes, figures, different methods of data presentation(graph, chart) - tables, sign conventions followed - conclusions and recommendations – bibliography.

Preparation of manuscript and posters - writing review article and book reviews- Funding agencies and schemes available - preparing research proposals for grants - ethics in scientific publication - formats for some national and international journals – knowledge about publishers such as ACS, RSC, elsevier, springer – wiley inter science – Taylor and Francis etc – publications from national scientific institutions (CSIR, IASc, IISc) (30 Hours)

UNIT III: ERROR ANALYSIS:

Types of error- accuracy, precision, significant figures –frequency distribution, the binomial distributions, the poisson distribution and normal distribution- different methods to reduce systematic errors –mean and standard deviation - Q-test, paired t test, T-test, F-test, analysis of variance (ANOVA)- comparing the means of two samples-correlation and regression its mathematical procedure-error in the slope and intercept t- Pearson's correlation coefficient - fitting of linear equations, r-values, multiple linear regression analysis(basic idea)-usage of computer software for statistical analysis (30 Hours)

UNIT IV: ANALYTICAL TECHNIQUES-I:

METHODS OF SEPARATION: Distinction between separation and purification - basic principles of separation techniques - filtration, crystallization, fractional distillation - steam and vacuum distillation - solvent extraction

CHROMATOGRAPHY: Paper, column, ion-exchange, gas chromatography GC-MS, LC - MS – MALDI and HPLC techniques and application (30 Hours)

UNIT V

ANALYTICAL TECHNIQUES-II:

ELECTRO CHEMICAL METHODS: Voltammetry – principles - linear sweep voltammetry – cyclic voltammetry, differential pulse voltammetry – electrodes and electrolytes - Pulse polarographic methods – applications

Principles and instrumentations : Atomic Force Microscopy (AFM), powder XRD,

Scanning Electron Microscopy (SEM) - Transmission Electron Microscopy (TEM) and

HRTEM - Scanning Tunneling Spectroscopy (STS) - Scanning Tunneling Microscopy

(STM) - Thermo Gravimetric Analysis (TGA) - Differential Thermal Analysis (DTA) -

Differential scanning calorimetry (DSC)

(30 Hours)

BOOKS FOR REFERENCE

UNIT I:

1. <http://www.inflibnet.ac.in>
2. <http://www.springerlink.com>
3. <http://www.sciencedirect.com>
4. C.R. Kothari, Research methodology, Methods and Techniques, Wiley Eastern Ltd., New Delhi, 1991

UNIT II:

1. H. Beall and J. Trimbur, A short guide to Writing about Chemistry, Longman, 2nd Edition, 2001
2. J. Anderson, B.H. Durston and M. Poole, Thesis and Assignment Writing, John Wiley, Sydney, 1970
3. Ralph Berry, The Research Project:,How to write it, 4th edition, Routledge,Taylor and Francis, London, 2000
4. M.Coghill and L.R.Gardson,The ACS Style Guide-Effective Communication of Scientific information, Oxford University Press, 3rd edition 2006

UNIT III:

1. Mendham,J.,Denney,R.C.,Barnes, J.D.and Thomas M.J.K Vogel's Text Book of Quantitative Chemical Analysis, Pearson Education, New Delhi, 6th edition, 2004.
2. Skoog and West,D.M.,Holler,J.F.and Crouch S.R., Fundamentals of Analytical Chemistry Thomson Asia Pvt. Ltd., Singapore, 8th edition, 2006
3. Willard, H.H., Jr.Merrit, L.L., Dean.J.A. and Jr.Settle, F.A., Instrumental Methods of Analysis, CBS Publishers and Distributers, New Delhi, 7th edition 2008
4. S.P.Gupta, Statistical Methods, Sultan Chand and Sons, New Delhi, 1993
5. D. Brynn Hibbert and J.Justin Gooding, Data Analysis, Oxford University Press, New York, 2006

UNIT IV:

1. Budhiraja, Separation Chemistry, New age International(P)Ltd, New Delhi, 2nd edition , 2007
2. Mendham, J. Denney, R.C., Barennes, J.D. and Thomas M.J.K Vogel's Text Book of Quantitative Chemical Analysis, Pearson Education, New Delhi, 6th edition, 2004
3. Skoog and West, D.M., Holler, J.F. and Crouch S.R., Fundamentals of Analytical Chemistry, Thomson Asia Pvt. Ltd., Singapore, 8th edition, 2006
4. Willard, H.H., Jr. Merrit, L.L., Dean. J.A. and Jr. Settle, F.A., Instrumental Methods of Analysis, CBS Publishers and Distributers, New Delhi, 7th edition, 2008

UNIT V:

1. Mendham,J. Denney,R.C., Barennes,J.D and Thomas M.J.K Vogel's Text Book of Quantitative Chemical Analysis, Pearson Education, New Delhi, 6th edition, 2004
2. Skoog and West, D.M.,Holler, J.F. and Crouch S.R.,Fundamentals of Analytical Chemistry Thomson Asia Pvt.Ltd., Singapore, 8th edition, 2006
3. Willard,H.H.,Jr. Merrit,L.L., Dean.J.A. and Jr. Settle, F.A., Instrumental Methods of Anlysis, CBS Publishers and Distributers, New Delhi, 7th edition, 2008
4. Fujita,H., Micromachines as Tool for Nanotechnology, Chapters 5 & 8, Springer-Verlag Berlin Heilderberg, 2003

PAPER II- ADVANCES IN CHEMISTRY

Semester: I

Hours: 14

Code : 20MCH1C02

Credits: 12

COURSE OUTCOMES

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO-1	Analyze the guidelines for best disconnection	PSO-1	U, An
CO-2	Illustrate asymmetric synthesis using Cramers rule and Prelogs rule	PSO-2	U, E
CO-3	Recognize the importance and principles of green chemistry	PSO-4	Ap, An
CO-4	Gain knowledge on nanotechnology	PSO-1	K, U
CO-5	Evaluate the uses of inorganic metals in our day to day life	PSO-2	U, E
CO-6	Explain the principles and instrumentation of various spectroscopic techniques	PSO-6	U, Ap
CO-7	Predict the structure of organic compounds using spectroscopic techniques.	PSO-7	Ap, An

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : I		ADVANCES IN CHEMISTRY										Hours: 14	
Code : 20MCH1C02												Credits: 12	
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's	
	1	2	3	4	5	6	1	2	3	4	5		
CO1	3	3	4	3	4	4	3	4	3	3	3	3.36	
CO2	3	4	3	4	3	3	3	4	4	4	4	3.54	
CO3	3	3	4	3	3	3	4	3	3	4	3	3.27	
CO4	3	4	3	4	3	3	4	3	3	4	4	3.45	
CO5	3	.4	3	3	4	2	4	4	3	2	4	3.27	
Overall Mean Score												3.38	

Result: The score for this course is **3.38** (High Relationship)

Note:

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Introduction - Retro synthesis, guidelines for best disconnections - one group disconnection 1,2-1,3-1,4-1,5 and 1,6-difunctional disconnections - stereoselectivity, regioselectivity, protecting groups, use of aliphatic nitro compounds in organic synthesis Asymmetric synthesis - strategy classification of methods, enantiometric excess and diastereometric excess - first, second, third and fourth generation process, enantioselective asymmetric synthesis **(42 Hours)**

UNIT II

GREEN CHEMISTRY:

Twelve Principles of green Chemistry – green chemical methods of synthesis –use of microwave in organic synthesis - solventless reactions - green solvents - supercritical fluids for extraction - ionic liquids

NANO CHEMISTRY:

Introduction to nano technology and nanomachines - molecular nanotechnology- methods of synthesis of nanomaterials - plasma arching, sol gels - electro deposition - ball milling - analytical tools to study nano materials (SEM & TEM) applications of nano Chemistry - CNT, molecular Switches – rotaxanes – catenanes - lithography - nano structured ferromagnetism - quantum wells, dots, wires applications of nanomaterials -nanomachines - future applications

(42 Hours)

UNIT III: BIOINORGANIC CHEMISTRY:

Bioinorganic chemistry of quintessentially toxic metals-lead, cadmium, mercury, aluminium, chromium, iron, copper - detoxification by metal chelation-metals used for diagnosis and chemotherapy - chelation therapy - dimercaptol, pencillamine, EDTA - gold complexes and rheumatoid arthritis – platinum based anticancer drugs- interaction with DNA - nonplatinum anti tumour metal complexes - metal complexes of radiodiagnostic agents - MRI contrast agents (Lanthanides) **(42 Hours)**

UNIT IV

SPECTROSCOPY I:

UV-Visible Spectroscopy: Types of electronic transitions and band assignments, band shifts, isosbestic bands microstates -term symbols and energy levels for d^1 - d^9 systems-electronic spectra of transition metal complexes (from d^1 to d^9)

configurations)-intensity of bands - effect of distortion and spin orbit coupling on spectra-evaluation of $10dq$ and β values for octahedral complexes of cobalt and nickel-charge transfer spectra

IR and Raman Spectroscopy:Sampling Techniques- combined applications of IR and Raman spectroscopy in structural elucidation of simple molecules like N_2O , ClF_3 , NO_3^- , ClO_4^- . effect of co-ordination on ligand vibrations - uses of group vibrations in the structural elucidation of metal complexes of urea, thiourea, cyanide, thiocyanate, nitrate, sulphate and DMSO- effect of isotopic substitution on vibrational spectra of metal carbonyls with reference to the nature of bonding, geometry and number of C-O stretching vibrations (group theoretical treatment)-applications of raman spectroscopy

Massbauer Spectroscopy:Isomer shifts - magnetic interactions - moss bauer emission spectroscopy - application to iron and its compounds **(42 Hours)**

UNIT V

SPECTROSCOPY II:

1H NMR Spectroscopy : Chemical shift – number of signals- peak areas-multiplicity-geminal-vicinal and long-range couplings-factors affecting these parameters

^{13}C NMR Spectroscopy :Broad band of off-resonance decoupling, comparison of 1H and ^{13}C NMR –factors affecting intensity of signals-chemical shifts- γ -gauche effect

2D NMR: NOESY and COSY, application of 1H NMR and ^{13}C NMR in structure elucidation.

Mass spectroscopy: Basic principles - molecular ion peak, parent ion peak, meta stable peak, nitrogen rule isotope peaks - determination of molecular weight and molecular fragment-fragmentation pattern of simple organic molecules - McLafferty rearrangement – Retro Diels Alder reaction

ESR spectroscopy: Basic concepts-factors affecting the magnitude of g and A tensors in metal complexes-anisotropy in g and A values – zero field splitting and Kramers degeneracy-applications of EPR to Cu (II) and Mn (II) complexes combined spectroscopy problems involving IR, UV, Mass and NMR **(42 Hours)**

REFERENCE BOOKS

1. Robert E., Ireland, Organic Synthesis, 2nd Edition, Prentice-Hall of India Pvt.Ltd, New Delhi, 1988. **Unit I**

2. Mackie R. K. and Smith D. M. Guide book to organic synthesis, London, ELBS, 1982
3. Stuart Warren, Organic Synthesis, The Disconnection Approach, John Wiley & Sons, 1982. **Unit I**
4. Ahluwalia, Kidwai, New Trends in Green Chemistry, 2nd Edition, Anamaya Publishers, New Delhi, 2006. **Unit II**
5. C.N.R. Rao, A. Muller and A. Cheethan Chemistry of nanomaterials, Wiley, New York, 2004 **Unit II**
6. Bertni, Gray, Lippard, Valentine, Bioinorganic chemistry, 1st ed., Viva Books Pvt. Ltd, New Delhi, 1998. **Unit III**
7. Kemp W, Organic Spectroscopy, 3rd edition, ELBS with Macmillan, London, 1993. **Unit IV**
8. R.M. Silverstein, G.C. Bassler and T.C. Morrill, Spectrometric Identification of Organic Compounds, 5th ed., Wiley, 1991, **Unit IV, V**
9. R.S. Drago, Physical Methods in Inorganic Chemistry, W.B. Saunders Company, 1992 **Unit IV, V**
10. Colin N. Banwell and Elaine M. McCash, Fundamentals of Molecular spectroscopy, TATA McGraw Hill Co., 4th edition, 2007 **Unit V**

INDEPTH STUDY (INTERNAL ONLY)
CHEMISTRY OF METAL COMPLEXES

Semester: I

Hours: 6

Code : 20MCH1E3A

Credits: 5

COURSE OUTCOMES

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO-1	Describe the theories of co-ordination chemistry	PSO-1,2	K, U
CO-2	Predict the methods of syntheses of Schiff bases	PSO-3,4	U, Ap,An
CO-3	Apply the biological importance of Schiff bases	PSO-4,5,6	U, Ap,An
CO-4	Interpret the binding ability of Schiff bases to biologically important molecules	PSO-4.6	U, An,Ap
CO-5	Analyse the recent developments published in reputed journals	PSO-1,2,4	U,C, Ap, An

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : I		CHEMISTRY OF METAL COMPLEXES										Hours: 6
Code : 20MCH1E3A												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO1	4	4	4	3	3	4	3	4	4	4	3	3.63
CO2	4	4	4	3	3	4	3	3	3	4	3	3.45
CO3	3	4	3	4	3	3	3	4	4	4	4	3.54
CO4	3	4	4	3	4	4	4	3	3	3	4	3.54
CO5	3	4	4	3	4	3	4	4	3	4	3	3.54
Overall Mean Score											3.54	

Result: The score for this course is **3.54** (High Relationship)

Note:

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I: INTRODUCTION TO COORDINATION COMPOUNDS

Brief review of the general characteristics of transition elements, nomenclature of coordination complexes, isomerism in coordination compounds, types of ligands and chelate effect, VB theory and CFT - Splitting of d-orbitals under different geometries – CFSE – evidence for CFSE-factors affecting CFSE - Jahn-Teller distortion-application of d-orbital splitting to explain magnetic properties, low spin and high spin complexes, –Limitations of CFT **(18 Hours)**

UNIT II: CHEMISTRY OF SCHIFF BASES

Schiff bases – various methods of synthesis – conventional – microwave assisted synthesis – purification – structural confirmation – spectrophotometric techniques. **(18 Hours)**

UNIT III: BIOLOGICAL IMPORTANCE OF SCHIFF BASES

Antioxidant - Antiinflammatory – Antifungal – Antibacterial – Anticancer activities – methods – Analysis. **(18 Hours)**

UNIT IV: INTERCALATION STUDIES

DNA and BSA interaction – binding constant – absorption – emission techniques – CV studies – molecular docking studies. **(18 Hours)**

UNIT V: JOURNAL REVIEW

Review of recent three research articles related to Schiff bases **(18 Hours)**

BOOKS FOR REFERENCE:

1. James E. Huheey Inorganic Chemistry, Dorling Kindersley Pvt. Ltd., 4th edition, 2012
2. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic chemistry, Milestone publishers and Distributor, Delhi, 31st edition, 2010
3. Web resources

NANOCHEMISTRY AND PHOTOCATALYSIS

Semester: I

Hours: 6

Code : 20MCH1E3B

Credits: 5

COURSE OUTCOMES

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO-1	Grasp the importance of nanochemistry	PSO-1,2	K, U
CO-2	Demonstrate the synthesis of nanoparticles	PSO-1	U, Ap,An
CO-3	Interpret the spectral data for characterization of nanomaterials	PSO-2,4	U, Ap,An
CO-4	Apply the photocatalysis to degradation of dyes	PSO-5	U, Ap
CO-5	Analyze critically the recent articles on photocatalytic activity by nanomaterials	PSO-2,5	U,C, Ap, An

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : I		NANOCHEMISTRY AND PHOTOCATALYSIS										Hours: 6
Code : 20MCH1E3B												Credits: 5
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO1	4	4	3	3	3	3	3	4	4	4	3	3.45
CO2	4	4	4	3	3	4	3	3	3	4	3	3.45
CO3	3	4	3	4	3	3	3	4	4	4	4	3.54
CO4	3	4	4	3	3	4	3	3	3	3	4	3.36
CO5	3	4	4	3	4	3	4	4	3	4	3	3.54
Overall Mean Score											3.47	

Result: The score for this course is **3.47** (High Relationship)

Note:

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I

Nanotechnology-Nanoparticles - Introduction - nanomaterials -Types of nanomaterials -nanocomposites -types of nanocomposites- properties of nanomaterials - methods of synthesis of nanomaterials - plasma arching, sol gels - electro deposition - mechanical grinding- co-precipitation method -sol-gel process- gas phase synthesis - Synthesis of nanoparticles using plant extracts (18 Hours)

UNIT II

Characterization of nanoparticles - UV-DRS - UV- visible, IR - SEM - TEM- X-ray Diffraction - Applications of nanomaterials (18 Hours)

UNIT III

Water pollution - organic pollutants from industries - agriculture - synthetic dyes- industrial effluents- toxic effect of dyes - impact of dyes on environment - removal of dyes - nanomaterials as photocatalysts (18 Hours)

UNIT IV

Principles of photo catalysis- operating principle -application of photo catalysts and photo catalytic reactor -experimental method for photocatalytic degradation of organic pollutant - sunlight irradiation-Uv -irradiation - mechanism of degradation - photo catalytic properties of metal oxides (18 Hours)

UNIT V

Five latest Research articles related to the project has to be studied and reported by the student under the concerned project supervisor. (18 Hours)

BOOKS FOR REFERENCE

1. C.N.R. Rao, A. Muller and A. Cheethan Chemistry of nanomaterials, Wiley, New York, 2004
2. B. K. Sharma, Industrial Chemistry, 2008, 14th edition, Goel publishing house, Meerut
3. B.viswanathan, Nanomaterials, Narosa publishing house,New Delhi, I edition, 2013
4. Chaudhery Mustansar Hussain and Ajay Kumar Mishra, Nanotechnology in Environmental Science, Wiley-VCH Verlag GmbH & Co. KGaA, I edition, 2018
5. Preeti Singh, M.M. Abdullah, and Saiqa Ikram, Role of Nanomaterials and their Applications as Photo-catalyst and Sensors: A Review, Medical publications, 2015

CORROSION AND ITS CONTROL METHODS

Semester: I

Hours: 6

Code : 20MCH1E3C

Credits: 5

COURSE OUTCOMES

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO-1	Gain knowledge on mechanism of corrosion	PSO- 2,4	K, U
CO-2	Analyze the factors influencing corrosion	PSO-1,5	U, An
CO-3	Classify the forms of corrosion	PSO-1,4	U, Ap
CO-4	Apply the control methods for corrosion	PSO-4,6	U, Ap
CO-5	Evaluate the methods of studying inhibitors	PSO-1,5	U, Ap, An

RELATIONSHIP MATRIX FOR COURSE OUTCOMES, PROGRAMME OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : I		CORROSION AND ITS CONTROL METHODS										Hours: 6	
Code : 20MCH1E3C												Credits: 5	
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's	
	1	2	3	4	5	6	1	2	3	4	5		
CO1	3	4	3	3	4	3	4	3	3	4	3	3.36	
CO2	3	4	4	3	3	4	3	3	4	4	4	3.54	
CO3	3	3	4	3	3	3	4	3	3	4	3	3.27	
CO4	3	4	3	4	3	3	4	3	3	4	4	3.45	
CO5	3	4	3	4	4	3	3	4	3	4	4	3.54	
Overall Mean Score												3.43	

Result: The score for this course is **3.43** (High Relationship)

Note:

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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UNIT I: INTRODUCTION TO CORROSION

Definitions - Historical background -importance of corrosion studies - cost of corrosion- theory- Methods of corrosion prevention and control- Mechanism of corrosion processes- Expressions for corrosion rate **(18 Hours)**

UNIT II: FACTORS INFLUENCING CORROSION

Material, environment, stress, geometry and time

DIFFERENT FORMS OF CORROSION

Localized, Metallurgically influenced, Mechanically assisted degradation and Environmentally induced cracking **(18 Hours)**

UNIT III: CLASSIFICATION OF CORROSION

Dry or chemical and Wet or electrochemical

PRINCIPLES OF CORROSION

Metallurgical, Physical and chemical, Thermodynamic and Electrochemical **(18 Hours)**

UNIT IV: INHIBITORS

Classification-Functioning of organic inhibitors Mechanism of inhibition action-Theories of corrosion inhibition: Adsorption theory, Hydrogen over potential theory, Film formation theory and Electrochemical polarization theory **(18 Hours)**

UNIT V: METHODS OF STUDYING INHIBITORS

Non – electrochemical methods: Gas volumetric method and Weight loss method - Electrochemical methods: Polarization method and AC impedance spectroscopy -Determination of surface coverage- Spectroscopic methods Biocidal studies Other methods: X-ray photoelectron spectroscopy (XPS), X-ray diffraction (XRD), Scanning electron microscopy (SEM) and Atomic force microscopy (AFM) **(18 Hours)**

REFERENCE BOOKS

1. Mars G Fontana, Corrosion engineering, McGraw Hill Education; 3 edition, July 2017.
2. U.R. Evans, An Introduction to Metallic Corrosion, 2 edition. London: Arnold, 1972.
3. H.H. Uhlig and R. Winston, Corrosion and Corrosion Control, 3 edition, New York: John Wiley and Sons, 1985.

PROJECT

Semester: II

Code : 20MCH2R01

Credits: 15

COURSE OUTCOMES

CO. NO.	UPON COMPLETION OF THIS COURSE THE STUDENTS WILL BE ABLE TO	PSO ADDRESSED	COGNITIVE LEVEL
CO-1	Interpret the spectral data of compounds	PSO-3	U, An
CO-2	Analyse the spectro photometric , analytical, electrometric measurements of compounds	PSO-4	U, An
CO-3	Develop the presentation skills through reviews	PSO-7	Ap, E
CO-4	Analyse critically the new findings of their research	PSO-6	U, An
CO-5	Formulate the procedure of manuscript and dissertation for their new research findings	PSO-7	Ap, An

RELATIONSHIP MATRIX FOR COURSE OUTCOMES AND PROGRAMME SPECIFIC OUTCOMES

Semester : I		PROJECT										Credits: 15
Code : 20MCH2R01												Credits: 15
Course Outcomes	Programme Outcomes (PO)						Programme Specific Outcomes (PSO)					Mean Score of CO's
	1	2	3	4	5	6	1	2	3	4	5	
CO1	5	4	3	2	3	5	3	5	3	4	5	3.8
CO2	4	3	3	4	4	5	5	5	3	3	4	3.9
CO3	3	3	4	3	5	4	4	3	4	5	3	3.7
CO4	3	2	4	5	4	3	5	4	3	5	2	3.6
CO5	2	3	4	4	3	5	4	3	3	4	5	3.6
Overall Mean Score											3.72	

Result: The score for this course is **3.72** (High Relationship)

Note:

Mapping	1-20%	21 - 40%	41 - 60%	61 - 80%	81 - 100%
Scale	1	2	3	4	5
Relation	0.0 - 1.0	1.1 - 2.0	2.1 - 3.0	3.1 - 4.0	4.1 - 5.0
Quality	Very Poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of Cos = $\frac{\text{Total of Values}}{\text{Total No. of Pos \& PSOs}}$	Mean Overall Score for Cos = $\frac{\text{Total of Mean Scores}}{\text{Total No. of Cos}}$
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Continuous Internal Assessment Component (CIA)

Theory:

Component	Marks	Marks
Internal test I	40	Converted to 25
Internal test II	40	
Seminar	10	
Term Paper	5	
Attendance	5	
Total	100	25

Internal Question Pattern - (Maximum Marks-40)

5 Questions × 8 Marks = 40 Marks

(Internal Choice and One Set of Question from each Unit)

External Question Pattern-(Maximum Marks-75)

5 Questions × 15 Marks = 75 Marks

(Internal Choice and One Set of Question from each Unit)

PASSING MINIMUM

Semester Examination	
Theory	50% out of 75 Marks (i.e. 37.5 Marks)

Project Work

The ratio of marks for Internal and External Examination is 50:50.

The Internal Components of Project: 50 Marks

Components	Marks
First Review	10
Second Review	10
Final Review (Internal Viva Voce)	30
Total	50

External Valuation of Project Work: 50 Marks

Components	Marks
Dissertation	25
External Viva Voce	25
Total	50

Continuous Internal Assessment (CIA)

Indepth Study Course (Maximum: 100Marks)

Component	Marks
Internal Test I	30
Internal Test II	30
E-Content Preparation	10
Seminar Paper Presentation (1)	15
Journal Format Submission (1)	15
Total	100

Internal Question Pattern for Indepth Study Course

(Maximum Marks-30)

3 Questions × 10 Marks = 30 Marks

(Open Choice Three Questions out of Five)

*Mid Semester and End Semester examinations will be conducted in the I Semester and assessment in the II Semester

DATE OF COMPLETION OF VIVA- VOCE EXAMINATION FOR M. Phil

Submission Date	Viva-Voce Examination
30 th June	31 st August
30 th September	November
10 th January	April