



Thursday, the 27th April, 2017

NOTIFICATION

No. : 28/2017

Date : 27/04/2017

Subject : I) Continuation of Prospectus No.2016123 prescribed for B.Sc.Final for the Session 2017-18.

II) Introduction of new subjects i.e. Forensic Science & Animation for B.Sc. Final from the session 2017-18.

I) It is notified for general information of all concerned that the Prospectus of B.Sc.Final (Sem-V & VI) bearing No.2016123 prescribed for the Academic Session 2016-17 shall continue for the session 2017-18 along with the following substitutions/additions.

“The syllabi of B.Sc.Final Sem-V ‘5S Mathematics, Paper IX & Paper X’ printed on page Nos.1 to 2 and B.Sc. Final Sem-VI ‘6S Mathematics, Paper XI & Paper XII’ printed page Nos. 2 to 8 be substituted by the **Appendix-A** appended with this Notification.”

II) It is further notified for general information of all concerned that the authorities of the University have introduced the new subject **i) Forensic Science & ii) Animation**, at B.Sc. Final (Sem-V & VI) from the session 2017-18 as –

i) “5S Forensic Science (Forensic Psychology)” and “6S Forensic Science (Digital & Cyber Forensics)” as given in **Appendix-B**,

ii) “5S Animation (Advanced Graphics and Special Effects)” and “6S Animation (Introduction to 3D Animation)” as given in **Appendix-C** appended with the notification.

Sd/-

(Dr.A.P.Deshmukh)

Registrar

Sant Gadge Baba Amravati University

Appendix – A

Syllabus Prescribed for B.Sc. Final (Semester-V & VI) Examination to be implemented from the Academic Session 2017-18

Semester V

**5S Mathematics Paper –IX
(Mathematical Analysis)**

Unit-I : Riemann Integral: Integrability of continuous and monotonic functions, the fundamental theorem of integral calculus, mean value theorem of integral calculus.

Unit II : Improper integrals and their convergence, comparison and limit tests. Beta and gamma functions.

Unit-III : Continuity and differentiability of complex function, analytic function, Cauchy-Riemann equations, harmonic and conjugate functions, Milne-Thomson method.

Unit-IV : Elementary function, mapping by elementary function, Mobius transformation, fixed point, cross ratio, inverse and critical points, conformal mapping.

Unit-V : Metric spaces: Definition and examples of metric spaces, neighbourhood, limit point, interior point, open and closed sets, Cauchy sequences, completeness.

Reference Books :

1. R. R. Goldberg: Methods of Real Analysis, Oxford IBH publishing Co. New Delhi, 1970.
2. T. M. Karade, J. N. Salunke, K. S. Adhav, M. S. Bendre : Lectures on Analysis, Sonu Nilu Publication, Nagpur.
3. Walter Rudin: Principles of Mathematical Analysis, International students edition (Third edition)
4. T. M. Apostol :Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.,
5. S. Lang : Undergraduate Analysis, Springer-Verlag New York, 1983.
6. D. Somasundaram & B. Choudhari : A First Course in Mathematical Analysis, New Delhi. 1997.
7. Shanti Narayan : A Course of Mathematical Analysis, S. Chand & Co., New Delhi.
8. P. K. Jain & S. K. Kaushik : An Introduction to Real Analysis, S. Chand & Co. New Delhi, 2000.
9. R. V. Churchill and J.W. Brown, Complex Variables and Applications, 5th Edition, McGraw Hill, New York, 1990
10. Mark J Ablowitz and : A.S. Fokas, Complex Variable Introduction and Application, Cambridge University Press , South Asian Edition ,1998.
11. Shanti Narayan : Theory of functions of Complex Variable,,S.Chand and Co. New Delhi.
12. E.T.Copton,:Metric Spaces, Cambridge University Press ,1968.
13. P.K.Jain and K.Ahmed ,:Metric Spaces ,Narosa Publishing House, New Delhi 1996.
14. G.F.Simmons :Introduction to Topology and Modern Analysis, McGraw Hill, New York,1963.
15. T. M. Karade, J. N. Salunke, A. G. Deshmukh, M. S. Bendre: Lectures on Advanced Calculus, Sonu-Nilu Publication, Nagpur.
16. Murray R. Spiegel :Theory and Problems of Advanced Calculus, Schaum Outline Series.
17. S. C. Malik and Arora : Mathematical Analysis, Wiley Estern Ltd., New Delhi.

Semester V
5S Mathematics Paper –X
(Mathematical Methods)

- Unit-I** : Legendre's equation, Legendre's polynomials, generating function of $P_n(x)$, recurrence formulae for $P_n(x)$, orthogonality of Legendre's polynomial, Rodrigue's formula.
- Unit-II** : Bessel's equation, solution of Bessel's equation, generating function for $J_n(x)$, Recurrence formulae for $J_n(x)$. Strun-Liouville boundary value problem.
- Unit-III** : Fourier series, Fourier series for odd and even functions, half-range Fourier sine series and half-range Fourier cosine series.
- Unit-IV** : Laplace transform: Laplace transform of some elementary functions, existence of Laplace transform. properties of Laplace transform. Laplace transform of derivatives and integrals, multiplications of t^n and division by t , inverse Laplace transform, convolution property, application of Laplace transform in solving ordinary and partial differential equations.
- Unit-V** : Fourier Transform: Finite Fourier sine transform, inverse finite Fourier sine transform and cosine transform, Infinite Fourier transform, infinite Fourier sine transform and cosine transform, properties of Fourier transform, application to partial differential equations.

Reference Books :

- 1) Erwin Kreyszig : Advanced Engineering Mathematics, John Wiley and Sons, Inc. New York, 1999.
- 2) A. R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd. , London.
- 3) Frank Ayres : Theory and Problems of Differential Equations. McGraw Hill Book Company, 1972.
- 4) B. Courant and D. Hilbert : Methods of Mathematical Physics, Vol. I & II, Wiley-interscience, 1953.
- 5) T. M. Karade : Lectures on Differential Equations, Sonu-Nilu Publication, Nagpur.
- 6) I. N. Sneddon : Fourier Transforms, McGraw Hill Book Co.
- 7) Goel and Gupta : Integral Transforms, Pragati Prakashan , Meerut.
- 8) Raisinghaniya, M.D., Integral Transform, S.Chand & Co., N.D.

Semester VI
6S Mathematics Paper -XI
(Linear Algebra)

- Unit I** : Vector Space : Definition and example of vector spaces, subspaces, sum and direct sum of subspaces, linear span, linear dependence, independence and their basic properties, basis , finite dimensional vector spaces ,existence theorem for bases, invariance of the number of elements of a basis set, dimension.
- Unit II** : Linear transformations: Linear transformation and their representation as matrices, algebra of linear transformations, rank nullity theorem, change of basis.
- Unit III** : Dual Spaces: Dual space, bidual space and natural isomorphism, adjoint of a linear transformation, Eigen values and eigenvectors of a linear transformation.
- Unit IV** : Inner Product Spaces: Inner product spaces, Cauchy-Schwarz inequality, orthogonal vectors, orthogonal complements, orthonormal sets and bases, Bessel's inequality for finite dimensional spaces, Gram Schmidt orthogonalisation process.
- Unit V** : Modules: Modules, submodules, quotient modules, homomorphism and isomorphism theorems.

Reference Books:

1. I. N. Herstein: Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
2. N. Jacobson: Basic Algebra ,Vol. I and II W.H. Freeman, 1980 (Hindustan Publishing Co.)
3. Shanti Narayan : A Text Book Of Modern Abstract Algebra, S. Chand and Co. ,New Delhi
4. K. B. Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd. New Delhi, 2000
5. P.B. Bhattacharya, S. K. Jain and S. R. Nagpal : Basic Abstract Algebra (IInd Edition) Cambridge University Press Indian Edition, 1997
6. K. Hoffman and R. Kunze: Linear Algebra ,IInd Edition Prentice Hall, Englewood Cliffs, New Jersey, 1971.
7. S. K. Jain, A. Gunawardhana and P. B. Bhattacharya: Basic Linear algebra with MATLAB, Key College Publishing (Springer-Verlag), 2001.
8. S. Kumaresan : Linear Algebra, A Geometric Approach P Prentice Hall of India Pvt. Ltd. New Delhi, 2000 .
9. Vivek Sahai and Vikas Bisht : Algebra, Narosa Publishing House , 1997.
10. D. S. Malik, J. N. Mordeson and M. K. Sen : Fundamentals of Abstract Algebra , McGraw Hill International Edition 1997 .
11. T. M. Karade, J.N. Salunke, K. S. Adhav, M. S. Bendre : Lectures on Abstract Algebra. Sonu Nilu Publication. Nagpur (IInd Publication).
12. John B. Fraleigh : A First course in Abstract Algebra.
13. Joseph A. Gallian: Contemporary Abstract Algebra, Narosa publishing house.
14. P.B. Bhattacharya, S.K. Jain and S.R. Nagpal: First Course in Linear Algebra.
15. V. Krishnamurthy , V. P. Mainru, J.L. Arora: An Introduction to linear Algebra.
16. L. Smith: Linear Algebra, Springer-Verlag New York.

Semester VI
6S - Paper-XII (Optional)
(Graph Theory)

- Unit I** : Graph. Application of graphs, finite and infinite graphs, incidence and degree, isolated vertex, pendent vertex and null graph, isomorphism, subgraphs, walks, path and circuits, connected graphs and components, Euler graph, operation on graphs, Hamiltonian paths and circuits, travelling salesman problem.
- Unit II** : Trees, some properties of trees, pendent vertices in a tree, distance and centres in a tree, Rooted and binary trees, On counting trees, spanning trees.
- Unit III** : Fundamental circuits, Cutsets, Some properties of cutsets, all cutset in a graph, fundamental circuits and cutsets, connectivity and separability, planer graphs, Kuratowski's two graphs, different representation of planer graph, detection of planarity.
- Unit IV** : Vector space associated with a graph, circuit and cutset subspaces, Orthogonal vectors and spaces, Intersection and join of W_Γ and W_s .
- Unit V** : Incidence matrix, Submatrix of A(G), Circuit matrix, Fundamental circuit matrix B, Rank of B, an application to a switching network, cutset matrix, path matrix, adjacency matrix, the relationship among A_f , A_f and C_f .

Reference Books:

1. Narsingh Deo: Graph Theory with Application to Engineering and Computer Science, Prentice Hall Of India, New Delhi.,
2. Richard Johnson- Baugh : Discrete Mathematics, Macmillan Publishing Company 886, Third Avenue New York 10022
3. Olympia Nicodemi : Discrete Mathematics, C.B.S. Publ. and Distributors 485, Jain Bhavan Bholanath Nagar Shahadara New Delhi-32 India
4. Frank Harare : Graph Theory, Narosa Publishing House, 307, Shiv Centre D.B.C. Sector Ku Bazar New Bombay 400704,
5. S.A. Choudum: A first Course In Graph Theory, McMillan India Ltd. Mercatile House Magazine Street Bombay 10
6. E.L. Liu : Elements of Discrete Mathematics, McGraw Hill Book Company, New York
7. Seymour Lipschutz and Marc Lipson : Discrete Mathematics, TMH New Delhi (Schaum Outline series) 11th Edition.
8. J.N. Salunke : Boolean Algebra and Graph Theory Laxmi Publication Akot.

Semester- VI
6S Mathematics Paper- XII
(Special Theory of Relativity) (Optional)

- Unit -I** : **Review of Newtonian Mechanics.** Inertial frames, speed of light and Galilean relativity, relative character of space and time, postulates of special theory of relativity, Lorentz transformation and its geometrical interpretation, group properties of transformation.
- Unit -II** : **Relativistic Kinematics.** Composition of parallel velocities, length contraction, time dilation, transformation equation for components of velocities and acceleration of a particle, Lorentz contraction factor. The thermodynamics of moving systems : The two laws of thermodynamics for a moving system, the Lorentz transformation for thermodynamics quantities a) volume and pressure b) energy c) work d) heat e) entropy f) temperature
- Unit- III** : **Geometrical representation of space- time.** Four dimensional Minkowskian space-time of relativity, time like and space like intervals, proper time, world line, four vectors and tensors in Minkowskian space-time, past, present and future null cone, basic tensors, covariant, contrvariant, mixed, operations on tensors, outer product, inner product, quotient law.
- Unit- IV** : **Relativistic Mechanics.** Variation of mass velocity, equivalence of mass and energy, transformation equation for mass, momentum and energy, relativistic force and transformation equations for its components, relativistic Lagrangian and Hamiltonian, the energy momentum tensor.
- Unit-V** : **Electromagnetism:** Maxwell's equations of electromagnetic theory in vacuum, propagation of electric and magnetic field strengths, scalar and vector potential, transformation of electromagnetic four potential vector, transformation of charged density and current density, Lagrangian for a charged particle in electromagnetic field, the force on a moving charged- Lorentz force, Gauge transformation, four dimensional formulation of the theory, Maxwell's equation in tensor form, transformation for electric and magnetic field strength, energy momentum tensor of the electromagnetic field. component of T^{ij} in term of electric and magnetic strength.

Reference Books:

1. C. Molar : The Theory of Relativity, Oxford Clarendon Press, 1952.
2. P. G. Bergman : Introduction to The Theory of Relativity, Prentice Hall of India, Pvt. Ltd. 1969.
3. T.M. Karade, K.S. Adhav and M.S. Bendre: Lectures on Spacial Theory of Relativity, Sonu Nilu Publication, Nagpur
4. J. L. Anderson : Principles of Relativity Physics, Academic Press, 1967.
5. V. A. Ugarov : Special Theory of Relativity, Mir Publishers, 1979.
6. R. Resnick : Introduction to Special Relativity Wiley Eastern, Pvt. Ltd. 1972.

Semester VI
6S Mathematics Paper- XII
(Mathematical Modelling) (Optional)

- Unit-I** : The Process of applied mathematics. Setting of First-order differential equations – Qualitative Solutions Sketching.
- Unit-II** : Difference and Differential Equation growth models – single species population models. Population growth- An age structure model. The spread of Technological innovation.
- Unit-III** : Higher order linear models - A model for the detection of diabetes. Combat modes. Traffic models - Car-following models. Equilibrium speed distributions.
- Unit-IV** : Non-linear population growth models. Prey-Predator models. Epidemic growth models. Models from political Science -Proportional representation - cumulative voting, comparison voting.
- Unit-V** : Applications in Ecological and Environmental subject areas -Urban waste water management planning.

References Books :

- 1) Vol.1. Differential equation models, Eds. Martin Braun, C.S.Coleman, D.A.Drew.
- 2) Vol.2. Political and Related Models. Steven J. Brams, W.F. Lucas, P.D.Straffin (Eds)
- 3) Vol.3. Discrete and System models.W.F.Lucas, F.S.Roberts, R.M.Thrall.
- 4) Vol.4. Life Science Models. H.M.Roberts & M.Thompson.
- 5) All Volumes published as modules in Applied Mathematics, Springer-Verlag,1982.

Appendix-B

Syllabus of B.Sc. Part- III (Semester- V & VI) (Forensic Science)
5S Forensic Science (Forensic Psychology)
(Effective from session 2017-18)

The examination in Forensic Science of Fifth semester shall comprise of one theory paper, internal assessment and practical examination. Theory paper will be of 3 Hrs. duration and carry 80 marks. The internal assessment will carry 20 marks. The practical examination will be of 6 to 8 hours duration and carry 50 marks.

The following syllabus is prescribed on the basis of six lectures per week and 6 practical periods per batch per week. Each theory paper has been divided into 6 units. There shall be one question in every unit with internal choice for each of 12 marks & one compulsory question covering all the syllabus of Semester-III (8 marks).

B.Sc. Part- III (Semester- V)
5S Forensic Science (Forensic Psychology)

Total Lectures: 84

Marks: 80

Note: Figures to the right hand side indicate number of lectures.

- Unit I : The Science of Psychology** **14L**
Concepts of psychology- Definition of psychology, goals of psychology, History of psychology- Development of psychology, role of psychologist, Different perspectives in Psychology- Modern perspectives, Humanistic, behaviouristic, cognitive, psychodynamic. Types of psychology professions- Psychiatrist, Psychologist, Counsellor. The science and research methods- Interview, observation, case study method Professional and Ethical issues in psychology- APA code of conducts for Psychologist.
- Unit II : Theories of Personality** **14L**
Understanding personality: Definition- mainly all port's definition, stressing uniqueness, enduring characteristics, temperament. Approaches – Psychodynamic (Freud, Jung & Adler), Humanistic (Rogers & Maslow) Dispositional approaches – Type (Jung. Type A & B, Rotter and Big – 5 and Trait (Catelli) Behavioural Approaches - Locus of control and Social learning theory. Assessment of personality – Questionnaires, Rating Scales and Projective tests, biological model assessment of personality. Psychological theories: Learning behavioural theory, Psycho analytic theory, Cognitive theory, REBT.
- Unit-III :** **14L**
- A) The Content of Forensic Psychology** **[4L]**
History of Forensic Psychology (Historical Perspective), Defining Forensic Psychology. Importance of Forensic Psychology.
- B) Applying Social Psychology in the interpersonal aspects of legal system** **[5L]**
Before the trial begins: 1. Effect of police procedure and media coverage, 2. Eye Witness Testing: Problems and Solutions. The Central participation in trial, Effect of Attorney, Judges, Jurors, and Defenders.
- C) Legal Aspects of Forensic Psychology** **[5L]**
Introduction. Historical Background Survey into Psychological evidence in court. Ethical and Professional Issues. The role of Forensic Psychology. Civil cases, Criminal cases.
- Unit IV : Personality Disorders** **14L**
Defining and Diagnosing Personality Disorders. Odd-Eccentric Personality Disorders. Dramatic-Emotional Personality Disorders. Anxious-Fearful Personality Disorders. Alternative Conceptualization of Personality Disorder. Stress and Health: Stress Factors in the stress reaction. Coping with the stress. Statistics in Forensic Psychology. Descriptive Statistics, Inferential Statistics.

- Unit V :** **14L**
- A) Essentials of Forensic Psychology** **[6L]**
 Development of forensic psychology, Ethical standards of forensic psychology, Scientific methods used in forensic psychology, Importance of study of forensic psychology.
- B) Causes of criminal behaviour and Psychological theories** **[8L]**
 Psychological Factor & delinquency, ADHD & conduct disorder, Psychopathy & antisocial personality disorder, Sexual disorder, Substance abuse, Treatment.
- Unit VI : Investigative psychology** **14L**
 Criminal psychological profiling-Nature, definition. Psychological tests used Criminal psychological profiling, Psychological autopsy, Forensic hypnosis (Narco analysis), Polygraph, Stalking, The Psychology of violence.

**Semester- V
5S Forensic Science (Forensic Psychology)**

Total Laboratory sessions: 21 **Marks: 50**

List of Practical's

1. Reaction Time: Comparison of RT under simple and disjunctive conditions.
2. Concept Formation: Comparison of the speed of development of 2 types of concepts.
3. Thinking and Problem Solving.
4. Correlation coefficient Raven's Standard Progressive Matrices (SPM) and Abstract Reasoning (AR) scores.
5. Eysenck Personality Questionnaire
 - Conduction of Psychological tests – Intelligence test:
6. Wechsler's adult intelligence scale
7. Wechsler's intelligence scale for children
8. Standard progressive matrices by Raven.
 - Personality test:
9. Eysenck personality inventory
10. 16.P.F. by R.B. Cattle
11. Thematic apperception test.
12. Rorschak inkblot test
13. Aptitude test: Differential aptitude test.
14. Measuring Locus of control.

Distribution of Marks for Practical Examination.

Time: 4 – 6 hours	Marks: 50
Exercise- I	12
Exercise- II	12
Exercise- III	12
Viva-Voce	07
Record	07
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Total:	50

Books Recommended:

1. General Psychology by Cicarelli.
2. General Psychology by Vipin Kumar.
3. Behavior Modification, Martin Garry,(2002),7th edi.
4. Introduction to Psychology, Morgan, King, Weiss and Schopler, VII edition, (1989) McGraw Hill, India.
5. Abnormal psychology & modern life,Carson RC & Butcher JN (10th Ed) Harper-Collins NY.
6. Introduction to Psychology, Atkinson and Atkinson, (1975) Oxford IBH Publishing Co. Pvt. Ltd.
7. Introduction to Forensic Science in Crime Investigation By Dr.(Mrs.) Rukmani Krishnamurthy.
8. Experimental Psychology: An Introduction. Underwood. B. J. (1968). NewYork: Appleton Century Croft Ltd.
9. Psychological Testing. Anastasi, A.& Urbina, S. (1997) (7th ed.) International edition, Prentice Hall International, Inc.
10. Forensic Psychology, Graham J.Towel & David A. Crighton.
11. Psychological testing and the selection of police officers: BPS BLACKWELL Cochrane, R. E., Tett, R. P., Vandecreek, L. (2003). A National Survey. Criminal Justice and Behavior, 30(5), 511-537.
12. Criminal psychological profiling: Validities and abilities. Kocsis, R. N. (2003), International Journal of Offender Therapy and Comparative Criminology, 47(2), 126-144.
13. Prof. Paranjape N. V., Criminology and Penology, Central Law Publication, Allahbad.
14. Barlow & Durand. V. M. (2005) Abnormal Psychology, 6th Ed. New Jercey.

**Semester- VI
Forensic Science
6S Forensic Science (Digital and Cyber Forensics)**

Total Lectures: 84

Marks: 80

Note: Figures to the right hand side indicate number of lectures.

Unit I	:	14L
A) Introduction to Operating System		[5L]
Basics of Operating System, memory structure, concurrency, scheduling, synchronization & memory management, process description and control. Introduction to Operating System (Batch Operating System, Distributed operating system, etc) Introduction to Windows and Linux operating System.		
B) Introduction to Internet		[5L]
World Wide Web, E-mails, Chat, Search Engines, Network Security–Threats, Vulnerabilities, Access Control, Malicious Code (Virus, Worms, Trojans, etc.) Introduction to Security and Security model (CIA triad).		
C) Cyber Crime & Digital Evidence		[4L]
What is cyber crime, types of cyber crimes, Digital evidence, Digital Vs Physical evidence, nature of digital evidence, precautions while dealing with digital evidence.		
Unit II	:	14L
A) Incident Response		[8L]
Introduction to Incident Response Process (What is Computer Security Incident, What are the goals of Incident Response, Who is involved in Incident Response Process, Incident Response Methodology, Formulate a Response Strategy, Investigate the Incident.),Preparing For Incident Response, Overview of Preincident Preparation, Identifying Risk, After Detection of an Incident.		
B) Cyber Forensic Tools and Utilities		[6L]
Introduction, Examining a Breadth of Products, Cyber Forensic Tools Good, Better, Best: What's the Right Incident Response Tool for Your Organization?, Tool Review Forensic Toolkit, EnCase, Cyber check suites, what is disk Imaging etc. Specifications for Forensic tools Tested		
Unit III		14L
A) Evidence Collection and Analysis Tools		[7L]
Volatile and Non volatile, Evidences collection (Safeback, Gettime, FileList,Filecv and Excel, Getfree, Swapfiles and Getswap ,GetSlack, Temporary Files), Detailed Procedures for Obtaining a bit stream backup of hard drive, File System (Details of File system, Data Structure Of File System, Data Recovery in Different file system)		
B) Biometrics		[7L]
Introduction to Biometrics, What is Biometrics, Why use Biometrics, Model of Biometric system Various types of Biometric methods, User Acceptance, Evaluating Accuracy, Advantages & disadvantages General Biometric System (Identification and Verification), General Architecture Comparison of different Biometric Technologies, What makes Biometrics difficult.		
Unit IV	:	14L
Data and Evidence Recovery		
Computer and cyber forensic basics, Cell Phone / Mobile Forensics, Blue-Tooth, Computer Ethics and Application Programs. Data and Evidence Recovery-Formatted Partition Recovery, Data Recovery Tools, Data Recovery Procedures and Ethics, Fine Transfer Protocol (FTP), Preserve and safely handle original media, Document a "Chain of Custody", Complete time line analysis of computer files based on file creation, file modification and file access, Recover Internet Usage Data, Recover Swap Files/Temporary Files/Cache Files, Introduction to Encase Forensic Edition, Forensic Tool Kit (FTK) etc, Use computer forensics software tools to cross validate findings in computer evidence related cases.		
Unit V	:	14L
Cyber Forensics Investigation		
Technical issues – Security Technologies: Certification and key, Distribution, Cryptographic Applications, Digital Signature Protocols for Transactions, SSL-Secure, Socket Layer, SET-Secure, Electronic Transaction. Cyber Forensics Investigation- Introduction to Cyber Forensic Investigation, Investigation Tools, eDiscovery, Digital Evidence Collection, Evidence Preservation, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Encryption and Decryption methods, Search and Seizure of Computers, Recovering deleted evidences, Password Cracking.		
Unit VI	:	14L
Information technology law		
IT Act 2000: Scope, Objectives, E- Governance, Creation, Recognition and Verification of Digital Signature Digital Signature and Penalties under IT Act 2000, Certifying Authority and Controller. Emerging trends in Information Technology law. Ammendment of IT act 2008.		

Semester- VI

6S Forensic Science (Digital and Cyber Forensics)

Total Laboratory sessions: 21

Marks: 50

List of Practicals

1. Working with windows file (creation, modification, deletion, attributes) folder (creation, nesting, attributes)
2. Working with Linux- file (Creation, modification, deletion, attributes), folder (creation, nesting attributes).
3. Working with external storage devices using windows- Reading and writing data on floppy, CD,DVD, USB thumbdrive
4. Working with external storage devices using Linux-reading writing data on floppy, CD, DVD, USB, thumb drive.
5. Understanding LAN-client/server, user creation, password protection.
6. Use of internet- visiting websites with given URL, searching information using search engine.

7. Use of E-mail, creating e-mail, sending and receiving e-mails with attachments.
8. Tracing E-mail, finding senders IP address, of received email, tracing route of email received using tool available on internet, e.g. Visual Trace Route etc.
9. Identification, Seizure, Search of Digital media
10. Evidence Collection
11. Demonstration of various Forensic tools like Partition magic, Encase etc.
12. Data Recovery, Deleted File Recovery viewing small Disk.
13. Demonstration of Concealment Techniques (Cryptography PGP)
14. Formatting NTFS and EX2, EX3.
15. Case study of Biometric Techniques
16. Data Recovery integrated with forensic technology (2 nos.)
17. Mobile Forensic using cell phone forensic suit (2 nos.)
18. Computer Forensic Investigation Tools, Digital Forensics investigation Tools (2 nos.)
19. Creation & verification of Digital Signature (2 nos.)
20. Network Analysis (2 nos.)
21. Detail Analysis of E-mail, E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery (2 nos.)
22. Working on En Case Software (2 nos.)
23. Image processing using tools like, Photoshop, Corel Photo paint etc. (2 nos.)
24. E-Commerce (E-shopping of any product to understand the transaction and security issues) (2 nos.)

Distribution of Marks for Practical Examination.

Time: 4 – 6 hours

Marks: 50

Exercise- I	.....	12
Exercise- II	.....	12
Exercise- III	.....	12
Viva-Voce	.....	07
Record	.....	07

	Total:	50

Books Recommended:

1. Introduction to Forensic Science in Crime Investigation By Dr. (Mrs.) Rukmani Krishnamurthy.
2. Computer Forensics: Principles and Practices by Linda Volonino, Reynaldo Anzaldua and Jana Godwin - Pearson Prentice-Hall 2007.
3. Digital Evidence and Computer Crime, 2nd ed. By Eoghan Casey- Academic Press, 2004.
4. Scene of the Cybercrime: Computer Forensics Handbook by Syngress.
5. Operating system by Willam Stalling.
6. Computer Networking by Tanenbaum.
7. Computer Security Basics By Rick Lehtin.
8. Digital Forensics: Digital Evidence in Criminal Investigations by Angus McKenzie Marshall.
9. Cyber Forensic A Field Manual for Collecting, Examining and Preserving Evidence of Computer Crimes by Albert J Menendez. Auerbach Publications.
10. Cyber Forensic by Marecella Menendez.
11. Computer Forensic by Newman.
12. Cyber Crime Investigation Field Guide, by B Middleton.
13. E-Commerce: The Cutting Edge of Business, Kamlesh K. Bajaj & Debjani Nag, Tata McGraw Hill.
14. Cyber Law and E .Commerce, David Baumer, J C Poindexter, TMG Cyberlaw Simplified Vivek Sood, TMG.
15. E- Security, Electronic Authentication and Information Systems Security Sundeep Oberoi, TMG.
16. Firewalls and Internet Security: Repelling the Wily Hack.

Appendix-C

Syllabus Prescribed for B.Sc. Final (Sem-V & VI) to be implemented from the Academic Session 2017-18

Semester V

5S : Animation

Advanced Graphics & Special Effects

- Unit-I** : **Adobe After Effects:** introduction to compositing, explaining tool box with all types of tools: selection, orbit, track x-y camera, track z camera, anchor, grids, opacity, order, layer menu, timeline, etc.
- Unit-II** : Use of layer menus: effects, color key, etc; nested composition, preserve resolution, preserve frame rate, details of masking. Advanced keying and matting.

- Unit-III** : **Animation-1:** Manipulating speed, toggle hold key frame, key frame interpolation, key frame velocity, handles, etc.
Animation-2: Time stretch, remapping, linking layers and transformation.
Effects: study of all types of effects.
(explain each effect practically and let the student perform with it).
- Unit-IV** : **Adobe Premiere Pro:** Introduction to video production and broadcasting techniques, basics of video compositing and editing, measuring video time, detailed study of video technology, its types like NTSC, PAL, SECAM, etc. (Only introduction of these types is expected).
Encoding and recording video signals.
- Unit-V** : Video & real time streaming, brief idea of interlaced and non-interlace video, spatial compression, keying, etc. Study of different windows, basic editing and concept of transition, study of different types of video effects. (Detailed study of each with practical approach is expected).
- Unit-VI** : Introduction to **Sound Forge**, audio concepts, working with audio engineering. Processes and special effects via audio recording, saving the recorded file in different file formats like .mp3, .wav, .wma, etc.
Concepts of remixing. Creating instrumental remix, title scores. Looped sound, working the background sounds in web pages and in other applications
- Practicals** : Minimum eight experiments based on above contents are to be performed.

Recommended Books :

1. Recommended Text Book: Adobe After CS3 Profesional by Adobe Creative Team, Published by Adobe Press, 2009.
2. Recommended Text Books: Digital fashion illustration with Photoshop and Illustrator by Kevin Tallon; Published by Batsford 2008.
3. Reference books: Real word Adobe Illustrator CS4 by Mordy Golding; Published by Pretence-Hall of India, 2008.
4. Creative Suite 3 integration: Photoshop, Illustrator by Keith Martin; Published by Pretence-Hall of India, 2008.
5. Special edition using Adobe Photoshop 7 by Peter Bauer, Jeff Foster; Published by Pretence-Hall of India, 2008.

The Concerning teachers are also suggested to use other relevant material available on the net, to update the knowledge of the students...

Following are the recommended links, for further search-

- 1) www.tatamcgrawhill.com
- 2) www.books.google.co.in
- 3) www.penguinbooksindia.com
- 4) www.bookcafe.in
- 5) www.newindianbooks.com
- 6) www.newasiabooks.org

Semester VI
6S : Animation

Introduction to 3D Animation

- Unit-I** : **Autodesk 3D Max:** introduction to Autodesk 3Dmax, standard and extended primitives, cloning, managing and hierarchy, array, floaters.
- Unit-II** : Concept of segments, WSM and OSM and 3D modifiers-1, 3D modifiers-2. 2D shapes, SPLINE modeling-1, SPLINE modeling-2 and modifiers for shapes. Study of HSDS, FFD, poly and creating a fighter plane, compound objects.
- Unit-III** : Study of surfaces, patch, NURBS, all types of materials, ray tracing, architectural material and design viz. Map scalar and UVW mapping, render to texture, unwrap UVW, standard light-1, standard-2.
- Unit-IV** : **Advanced 3D Max:** Photometric lights, sky light and light tracer, environment exposure control, different effects, sun light and day light effects. Types of mental rays, RAM player and rendering techniques, using camera and camera map modifier, pixel based camera mapping.
- Unit-V** : Different types of video posts, controlling with motion panel, different types of attribute holders and wire parameters, curve editor. Interactive animation control, animation modifier, hierarchies and kinematics, IK and FK etc; types of schematic views, study of human anatomy, human body rigging, creating walk-cycle and using rigging, skin and skin morphing, skin wrap and skin wrap patch.
- Unit-VI** : **Autodesk Maya** : Introduction to NURBS modeling, basic dynamics used, brief idea of Maya Unlimited: hair, fur, cloth, fluid, etc.
(Brief introduction of each topic is expected only. This approach may be with or without practical).

Practicals : Minimum eight experiments based on above contents are to be performed.

Recommended Books :

1. 3Ds Max 2008 by Tickoo Sham, Published by Pearson Education, 2008.
2. Reference books: Introducing 3ds Max 2008 by Dariush Derakshshani, Randi Lorene Munn.
3. 3Ds Max 2008 In Simple Step, Published by Kogent Solutions Inc, 2008.
4. 3ds max 6 fundamentals by Ted Boardman, 2004.

The Concerning teachers are also suggested to use other relevant material available on the net, to update the knowledge of the students.

Following are the recommended links, for further search-

- 1) www.tatamcgrawhill.com
- 2) www.books.google.co.in
- 3) www.penguinbooksindia.com
- 4) www.bookcafe.in
- 5) www.newindianbooks.com
- 6) www.newasiabooks.org

NOTIFICATION

No. : 29/ 2017

Date : 27/04/2017

Subject : I) Continuation of Prospectus No.2015125 prescribed for M.Sc. (Chemistry) (Sem-I to IV) for the Session 2017-18.
II) Additional chances for the failure students of M.Sc.Sem-I & II (Che.)

- I) It is notified for general information of all concerned that the Prospectus of M.Sc. (Chemistry) Part-I & II (Sem-I to IV) bearing No.2015125 prescribed for the Academic Session 2016-17 shall continue for M.Sc. (Chemistry) Part- II (Sem-III & IV) for the session 2017-18 along with the new syllabi for M.Sc. (Chemistry) Part-I (Sem-I & II). The syllabi for M.Sc. (Chemistry) Part-I (Sem-I & II) printed on page Nos.1-26 be substituted by the **Appendix-A** appended with this Notification.”
- II) The authorities further provided two additional chances for the failure students of M.Sc. Sem-I & II (Chemistry) after implementation of the aforesaid new syllabi.

Sd/-
(Dr.A.P.Deshmukh)
Registrar
Sant Gadge Baba Amravati University

Appendix-A

Syllabus Prescribed for M.Sc. Semester-I & II (Chemistry) to be implemented from the Academic Session 2017-18

Semester I

Paper-I

Inorganic Chemistry-I

60hrs (4hrs/week). 12hrs/unit

80 Marks

- Unit-I : A) Stereochemistry and Bonding in Main Group elements: 6L**
VSEPR theory: Prediction of shapes of irregular molecules and ions like SbF_4^- , SF_5^- , SeF_3^- , ICl_2^- , IF_4^- , IOF_4^- , NH_2^- , NH_4^+ , I_3^- , PCl_2^+ , PCl_6^- etc. Drawbacks, bent rule, energetics of hybridization, d-orbital participation by non-metals, example showing $\pi\pi$ - $\pi\pi$, $\pi\pi$ - $d\pi$ and $d\pi$ - $d\pi$ bonds.
- B) Molecular Orbital Theory: 6L**
Molecular orbital representation of polyatomic molecules with special reference to CH_4 , NH_3 , H_2O , PF_5 , SF_6 , B_2H_6 and CO and delocalised molecular orbital of ozone, carbon dioxide, nitrite, nitrate and benzene.
- Unit-II : A) Metal-ligand bonding: 6L**
Recapulation of CFT, splitting of d orbitals in octahedral, square planar, tetrahedral, square pyramidal and trigonal bipyramidal complexes, Jahn-Teller distortion, spectrochemical series, nephelauxetic series, measurement of CFSE in weak/strong ligand fields, structural consequences of crystal field effects, variation of lattice energy and heats of hydration across 1st row transition metal ions, stabilization of unusual oxidation states and ionization energies, structure of mineral spinels. Limitations of crystal field theory.
- B) Molecular orbital theory of coordination compounds: 6L**
Theoretical failure of ionic model of CFT. Experimental evidences in support of metal ligand orbital overlaps. Adjusted crystal field theory (ACFT or LFT), Composition of ligand group orbitals, (SALC principle), molecular orbital energy diagrams of octahedral, tetrahedral, square planar complexes including both σ and π bonding; angular overlap model. Comparison of CFT, LFT and MOT.
- Unit-III : Boron hydrides & Metal Cluster: 12L**
Boron hydrides: Classification, nomenclature, structure, bonding and topology of boranes, 4-digit coding (s,t,y,x) numbers for B_2H_6 , B_4H_{10} , B_5H_9 , B_5H_{11} and B_6H_{10} and their utilities. Chemistry of diboranes. Acquaintance with metalloboranes, Carboranes and Metallocarboranes. Preparation, structure and bonding in Non-carbonyl metal clusters viz. Binuclear $(\text{Re}_2\text{Cl}_8)^{2-}$, Trinuclear $(\text{ReCl}_3)_3$, Tetranuclear $(\text{W}_4(\text{OR})_6)$ and Hexanuclear $(\text{Mo}_6\text{Cl}_6)^{4+}$ ions. Preparation, properties and structures of Zintl anions & cation of the metal Ge, Sn, Pb, Sb, Bi.
- Metal clusters:** Occurrence of metal-metal bonds, binuclear, trinuclear, tetranuclear, and octahedral clusters. Synthesis, properties and bonding, of carbides, sulphur-nitrogen (SN) compounds, peroxo compound of boron, carbon and sulphur, oxy acids of nitrogen, Isopoly and Heteropoly acids.
- Macrocyclic Complexes:** Types of macrocyclic ligands-design and synthesis by coordination template effect, di & poly-nuclear macrocyclic complexes, application of macrocyclic complexes

Unit-IV : A) Non-aqueous solvent behavior:

4L

Inorganic solutes in organic solvents. Solvent system concept. The role of solvents in chemical reactions, effect of physical and chemical properties. Inorganic reactions in the following non-aqueous solvents: Dinitrogen tetroxide, anhydrous sulphuric acid, bromine trifluoride, reaction in molten salts and Ionic liquids and Super critical CO₂ as solvent.

B) Metal-ligand equilibria in solution:

8L

A brief introduction to complex equilibria, outline of thermodynamic stability of metal complexes and factors affecting the such as temperature, dielectric constant and ionic strength, nature of metal ion and ligand, statistical, electrostatics, chelate effect. Experimental methods for the determination of stability constants by spectrophotometric methods (Job's and Mole ratio), Bjerrum's p_H metric method, polarographic method and Conductometric method. Relation between thermodynamic parameters (ΔG , ΔS , ΔH) and their importance in complex formation. Protonation and dissociation constant of ligand and their relationship. Mixed ligand complex and application of mixed ligand complexes. General treatment of the determination of formation constant of mixed ligand complexes.

Unit-V : Symmetry and group theory:

12L

Introduction to symmetry elements, symmetry operations, product of symmetry operations, equivalence symmetry elements and equivalence atoms, point group, classifications of point groups, Schoenflies symbols, identification of point groups of simple molecules like HCl, BeF₂, CO, H₂O, NH₃, CO₂, BF₃, C₂H₄, C₂H₆, C₂H₂Cl₂, C₆H₆, PCl₃, PCl₅, [PtCl₄]⁻, [PtCl₂(NH₃)₂], [CoCl₂(NH₃)₄], [FeF₆]³⁻ substituted benzene molecules, pyridine, ferrocene, SF₄, IF₅, etc., necessary conditions for any set of elements to form a group, subgroups, classes in a group. Application of point group. Group multiplication table, matrix representation of symmetry elements. Reducible and irreducible representation, character of representation, character of matrix, Conjugate matrix, Properties of irreducible representations, Great orthogonality theorem (without proof) and its importance, construction of character table of C_{2v} & C_{3v} point group. Mulliken symbolism rules for irreducible representations & its applications with examples.

BOOK SUGGESTED-

- 1) S.F. A. Kettle, J. N. Murrell & S. T. Teddler: Valency Theory
- 2) C.A. Coulson: Valency
- 3) J.E. Huheey :Inorganic Chemistry
- 4) F.A. Cotton & G. Wilkinson: Advanced Inorganic Chemistry 3rd, 5th & 6th Editions.
- 5) A.F. Williams: Theoretical Approach in inorganic chemistry.
- 6) A. Mannas Chanda: Atomic Structure and chemical Bonding
- 7) L.E. Orgel: An Introduction To transition metal chemistry, Ligand field theory, 2nd Edition.
- 8) J.J. Logowski: Modern Inorganic Chemistry
- 9) B. Durrant and P.J. Durrant: Advanced Inorganic Chemistry
- 10) J.C. Bailar: Chemistry of co-ordination compounds.
- 11) W.L. Jolly: Modern Inorganic Chemistry
- 12) R.S. Drago: Physical methods in inorganic chemistry.
- 13) Waddington: Nonaqueous solvents.
- 14) Sisler: Chemistry of nonaqueous solvents.
- 15) A.K. Barnard: Theoretical Inorganic Chemistry
- 16) Emeleus and Sharpe: Modern Aspect of Inorganic Chemistry.
- 17) F.A. Cotton: Chemical Applications of Group theory.
- 18) Jones: Elementary Co-ordination chemistry.
- 19) B.N. Figgis: Introduction to Ligand field.
- 20) S.F.A. Kettle: Co-ordination chemistry.
- 21) M.C. Day and J. Selbin: Theoretical Inorganic Chemistry.
- 22) J. Lewin and Wilkins: Modern Co-ordination chemistry.
- 23) Gowariker, Vishwanathan and Sheedar: Polymer science.
- 24) H.H. Jatney and M. Orchin: Symmetry in chemistry.
- 25) D. Schonland: Molecular Symmetry in chemistry.
- 26) L.H. Hall: Group theory and Symmetry in chemistry
- 27) H.H. Jatney and M. Orchin: Symmetry in chemistry
- 28) R.L. Dutta and A. Simal: Elements of magneto chemistry
- 29) Inorganic Chemistry 4th Edition, P. Atkins, Oxford University Press.
- 30) Essential Trends in Inorganic Chemistry, D.M.P. Mingos, Oxford University Press

Paper II
Organic Chemistry-I

Total Lectures: 60Hrs, 4 Hrs per week, 12 Hrs/unit

Total Marks-80

- Unit-I : Nature and Bonding in Organic Molecule 12L**
Delocalized chemical bonding, conjugation, cross conjugation, resonance, hyper-conjugation, bonding in fullerenes. strength of acids and bases. cryptands, inclusion compounds, cyclodextrins, catenanes and rotaxanes.
Aromaticity in benzenoid and non-benzenoid compounds, alternant and non-alternat hydrocarbons Huckel's rule, energy level of pi-molecules orbitals, annulenes, antiaromaticity, homo-aromaticity. Aromatic characters and chemistry of cyclopentadiene anion, tropyllium cation, tropene and tropelene. anti- and homo-aromatic systems. NMR as a tool for aromaticity. Conformational analysis of cycloalkanes (5 – 8 membered rings), decalines, effect of conformation on reactivity, steric strain due to unavoidable crowding, Conformation of glucose.
- Unit-II : Stereochemistry 12L**
Interconversion of Sawhorse, Newmann and Fischer projection. chirality, examples from common objects to molecules – axis, plane, center, alternating axis of symmetry. Stereoisomerism – definition based on symmetry and energy criteria – configuration and conformational stereoisomers. Center of chirality – molecules with C, N, S based chiral centers – absolute configuration - enantiomers – racemic modifications - R and S nomenclature using Cahn-Ingold-Prelog rules – molecules with a chiral center and C_n axis, molecules with more than one chiral center, threo and erythro isomers, method of resolution, optical purity, enantiotopic and distereotopic atoms, groups and faces, Prochiral relationship, stereospecific and stereoselective (w.r.t.Substrate stereoselectivity, product stereoselectivity, enantioselectivity and diastereoselectivity.) synthesis.Asymmetrical synthesis. Axial, planar and helical chirality – examples – stereochemistry and absolute configuration of allenes, biphenyls and binaphthyls, ansa and cyclophanic compounds, spiranes, exo-cyclic alkylidenecycloalkanes.
Topicity and prostereoisomerism – topicity of ligands and faces, and their nomenclature – NMR distinction of enantiotopic/diastereotopic ligands.
- Unit-III : Reaction mechanism: Structure and Reactivity 12L**
Types of mechanism, Types of reaction, thermodynamics and kinetics requirements, kinetic and thermodynamic control, Potential energy diagrams, transition states and intermediates, activated complex, methods of determining mechanisms, kinetic isotope effects, Hammond's postulate, Curtin-Hammett principle, Effect of Structure on reactivity:- Resonance and field effects, Steric effect, quantitative treatment. The Hammett equation and linear free energy relationship, substituent and reaction constants. Taft equation.
- Unit-IV : 12L**
A) Aliphatic nucleophilic substitution: The SN₁, SN₂, mixed SN₁, SN₂ and SET and SN_i mechanisms. Nucleophilicity, effect of leaving group, ambient nucleophiles and ambient substrates regioselectivity. The neighbouring group. Participation mechanism, substitution at allylic and vinylic carbon atoms.
B) Elimination Reactions: The E₁, E₂ and E_{1c}B mechanisms orientation of the double bond. Saytzeff and Hoffman's rule. Effect of substrate structure, attacking base, leaving group and medium. Pyrolytic elimination mechanism and orientation. Cleavage of quaternary ammonium salts. Conversion of vicinal dihalides and nitro compounds to alkenes.
C) Summary of factors controlling substitution and elimination by unimolecular and bimolecular mechanisms.
- Unit-V : A): AROMATIC ELECTROPHILIC SUBSTITUTION 12L**
The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The o/p ratio, ipso attack, orientation in benzene ring with more than one substituents, orientation in other ring system. Diazonium coupling, Gatterman-koch reaction, Pechman reaction, Houben –Hoesch reaction, Reimer-Tiemann reaction, Kolbe Schmitt reaction, Recapitulation of halogenation, nitration, sulphonation and F.C. reaction.
B) Aromatic Nucleophilic Substitution: A general introduction to different mechanisms of aromatic nucleophilic substitution S_NAr, S_N1, Benzyne and S_{RN}1 mechanisms, Reactivity effect of substrate structure leaving group and attacking nucleophile, The Von Richter, Sommet-Hauser and Smiles rearrangements.

BOOK SUGGESTED-

1. Advanced organic chemistry –Reaction mechanism and structure. Jerry March, John Wiley.
2. Advanced organic chemistry- F.A. Carey and R.J. Sunberg, Plenum.
3. A Guidebook to mechanism in organic chemistry-Peterskyes, Longman.
4. Structure and mechanism in organic chemistry-C.K. Gold, Cornell University Press.
5. Organic chemistry, R.T. Morrison Boyd. Prentice Hall
6. Modern organic chemistry-H.O. House, Benjamin.
7. Principal of organic chemistry-R.O.C. Norman and J.M. Coxon, Blackie Academic and Professional.
8. Reaction mechanism in organic chemistry-S.M. Mukharji and S.P. Singh, Macmilan.

9. Stereochemistry of organic compounds- D. Nasipuri, New age international.
10. Stereochemistry of organic compounds- P.s.kalsi, New age international.
11. Frontier orbitals and organic chemical reactions-I. Fleming.
12. Orbital Symmetry – R.E.Lehr & A.P. Marchand.
13. Reactive intermediate in organic chemistry-N. S. Isaacs.
14. Stereochemistry of carbon compounds- E.L.Eliel.
15. Physical organic chemistry-J. Hine.
16. Name reaction in organic chemistry –Surrey.
17. Advanced organic chemistry – L.F.Fieser and M. Fieser.
18. Vol.I & II organic chemistry - I. L. Finar.
19. Modern organic chemistry- J.D. Roberts and M. C. Caserio.
20. The search for organic reaction pathways (Longmann), Peter Skyes.
21. Organic chemistry 5th Edition (McGraw Hill), Pine.
22. Organic chemistry (Willard Grant Press Botcon), John Mcmurry.
23. A Textbook of organic chemistry- R.K. Bansal.
24. New trends in green chemistry –V.K. Ahluwalia & M. kidwai, Anamaya publishers New Delhi.
25. Organic Chemistry, J.Clayden, Oxford University Press.
26. Organic Chemistry, 4th Edition, G Marc Loudon, Oxford University Press.
- 27.. A guide book to Mechanism in Organic Chemistry:Petetr Sykes
28. Organic Chemistry: F. A. Carrey(Part A & B)

Paper - III
Physical Chemistry-I

60 Hours (4-Hours/week)12 hours/Unit

Total Marks-80

- Unit-I : Quantum Chemistry : 12L.**
A) Schrodinger's equation in one dimensional box (Recapitulation), postulates of quantum mechanics discussion of solution of Schrodinger's equation to particle in a three dimensional box, Harmonic oscillator, Rigid Rotor. The variation theorem, linear variation principle, perturbation theory (First order and non degenerate). Application of variation method and perturbation method to Helium atom.
B) Ordinary angular momentum, generalized angular momentum, eigen functions for angular momentum, eigen value of angular momentum. Pauli exclusion principle. Russel-Saunders terms & coupling schemes, Slater-Condon parameters Numerical.
- Unit-II : Surface Chemistry : 12L.**
A) Adsorption : Freundlich adsorption isotherm, Langmuir adsorption isotherm, Gibbs adsorption isotherm, estimation of surface area (BET equation), surface films on liquids, and catalytic activity at surfaces.
B) Micelles : micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization-phase separation and mass models, solubilization, micro emulsion, reverse micelles. Numericals.
- Unit-III : Thermodynamics : 12L**
A) Classical Thermodynamics : Partial molar properties. Partial molar free energy, Chemical Potential, Partial molar volume and Partial molar heat content and their significances. Determination of these quantities. Concept of fugacity and determination of fugacity. Debye-Huckel Theory for Activity coefficient of electrolytic solutions, Ionic strength, Determination of Activity & Activity coefficient.
B) Non equilibrium Thermodynamics : Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow for different irreversible processes (e.g. heat flow, chemical reaction, coupled reactions and electrochemical reactions). Transformations of the generalized fluxes and forces, phenomenological equations. Microscopic reversibility and Onsager's reciprocity relation. Numericals.
- Unit-IV : Nuclear Chemistry : 12L.**
A) General characteristics of radioactive decay, decay kinetics, parent daughter decay growth relationship, nuclear de-excitation, secular and transient equilibrium, α -particle energy spectrum, Geiger Nutta Law, theory of a band g decay process.
B) Fission energy natural Ur reactor, classification of reactor, reactor power, critical size of thermal reactor, excess reactivity and control, Breeder reactor, Reprocessing of spent fuel, Recovery of Ur and Plutonium Nuclear wate management.
- Unit – V : Chemical Dynamics : 12L.**
A) Theories of reaction rates : Collision theory, collision rates in gases, energy requirement and steric requirement. Dynamics of molecular collisions. Transition state theory : assumptions, Statistical Mechanics and Chemical equilibrium, derivations of Eyring equation, Application of transition state theory to reaction between atoms and molecules (e.g. The reaction $H + HBr (R) \rightarrow H_2 + Br$)
B) Unimolecular reactions : Lindemann-Christiansen hypothesis and Hinshelwood treatment, Marcus's extension of the RRK treatment.
C) Reactions in solution, Solvent effects on reaction rate. Factors determining reaction rate, Numericals.

BOOK SUGGESTED-

1. Physical chemistry by P. W. Atkins and Depaula 7th Edition
2. Introduction to Quantum chemistry by A. K. Chandra, Tata Mc
3. Quantum chemistry by Ira N. Levine.
4. Molecular quantum mechanics, Vol. I & II, P. W. Atkins, Oxford University Press, 1970.
5. Statistical thermodynamics, by T.L.Hill, Addison Wesley, 1060
6. Chemical thermodynamics, by F.T. Wall, W.H.Freeman & Co. 1965
7. Irreversible thermodynamics, Theory and applications, by K.S.Forland, T. Forland, S.KRatje, Jonny Witey, 1988.
8. Chemical Kinetics, by K. J. Laidler, 3rd Edition, Harper and row, 1987.
9. Chemical Kinetics-A study of reaction rate in solution, K.Conors, V.C.H.Publkatkm 1990.
10. Chemical Kinetics and Dynamics, By J.I.Streinfeld, J.S. Francisco & W.I.Hase, Pritice Hall, 1989.
11. Kinetics and Mechanism of Chemical transformation, J.Rajraman, J. Kucriacose, Mc-Million
12. Molecular reaction Dynamics and chemical reactivity, R.D.Levine and R.B. Benstin, Oxford University press. 1987.
13. Physical Chemistry by Alberty and Silby, Jolly Wiley
14. Essential of Quantum Chemistry by Anant Raman.
15. Introduction to Relativistic Quantum Chemistry, K.G.Dyall, Oxford University Press.
16. Molecular Quantum Mechanics, 4th Edition, P.W.Atkins, Oxford University Press

PAPER-IV

Modern Methods of Separation

60 Hours (4-Hours/week)12 hours/Unit

Total Marks-80

Unit-I : Basic concepts of Analytical Chemistry :

12L

Role of Analytical Chemistry: The nature of analytical chemistry, the role of analytical chemistry , qualitative and quantitative analytical methods, Classification of analytical methods-classical & instrumental. Types of instrumental analysis. Selecting an analytical method. Analytical balances: (Semi micro and Micro balances) and their use in analytical chemistry, Techniques of weighing and errors Good Laboratory Practices (GLP) : Introduction and principles of GLP, **Purification Techniques** : Introduction, purification techniques for solid organic compounds, purification techniques for liquids, chemical method of separation and purification and criteria of purity. Principal and Methods of sampling: Theory of sampling, pit falls and problems associated with sampling. Techniques of sampling of gases, liquids, solids and particulates. Stoichiometric calculations based on gravimetry and titrimetry analysis of commercial samples. Transmission and storage of samples. Effect of sampling uncertainties samplers' responsibility, sampling hazards.

Unit-II :

12L

Statistical Analysis: (Emphasis should be placed on numerical problems) Collection, Treatment and presentation of analytical data. True, standard and observed value. Defination of terms in mean and median. Errors in chemical analysis, classification of errors, nature and origin of errors. Accuracy and precession, errors in quantitative analysis and their minimization. Standard deviation, least squares and correlation coefficients. Confidence interval and confidence limit. Graphical method of solution, parameter and variable, comparison of manual mean curve and the computer programmed best fitting curve. Tests for rejection of data. T-test, F-test and Q-test. Significant figures and computation rules. Regression analysis and Statistical analysis of Chemical analysis. Numerical problems.

Unit-III : Separation Techniques:

12L

Advanced level treatment of solvent Extraction: Introduction, Liquid-liquid extraction-continuous and counter current extractions, synergic extraction, ion-pair or ion association extraction, Extraction by equilibrium shifts. Solid-liquid extraction, discontinuous infusion type extraction, application to the separation of alkali and alkaline earth metals. Numericals. **Ion-Exchange Separation:** Fundamental properties of ion exchangers. Theory of ion exchange, exchange capacity, screening effect, penetration of electrolytes into ion exchange resins, sorption of complex ions Cation and Anion exchangers, Action of ion exchange resins. Ion-exchange equilibria and ion exchange capacity. Strongly and weakly acidic cation exchangers. Strongly and weakly basic anion exchangers. Liquid ion exchangers, chelation ion exchangers, techniques of ion exchange, use of non aqueous solvents in one exchange separation, application of ion exchange separation in determination of total salt concentration, removal of interfering ions, separation of anions and metals and application in analytical chemistry. Separation using solvent mixture.

- Unit IV : Gas Chromatography : 12L**
Theory and Instrumentation of GC, Sample injection- Split and splitless injection, Column types, Solid/Liquid Stationary phases, Column switching techniques, Basic and specialized detectors, elemental detection, chiral separations, Gas chromatographs and chemical analysis, Interfacing of gas chromatography with mass spectrometry, Applications of GLC, Use of GC-MS, High Speed gas chromatography, Gas- solid chromatography and problems,
High Performance Liquid Chromatography (HPLC): Theory and instrumentation of HPLC, Optimization of column performance, Gradient elution and related procedures, Derivatization, Mobile phase delivery system, sample injection, separation column, detectors, Interfacing HPLC with mass spectrometry, Structure types of column packing, adsorption chromatography, Bonded phase chromatography, reverse phase chromatography, ion-pair chromatography, ion exchange chromatography, size exclusion chromatography, GC-MS and LC-MS, Applications and Problems
- Unit V : Chemical Safety and Handling of Chemicals: 12L**
Safe working procedure and protective environment, protective apparel, emergency, procedure and first aid, laboratory ventilation. Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric – safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals.
Explosives & Chemical weapons:
Chemical explosives: Origin of explosive properties in organic compounds, classification, characteristics-special explosives-nitrocellulose- T.N.T, Picric acid, preparation and explosive properties of lead azide, PETN, cyclonite (RDX), Dynamite-cordite and Gunpowder.
Introduction, Classification of chemical weapons, Chemical warfare agents, physical and chemical properties, toxicity and data, Better regulation of potential chemical weapons

BOOK SUGGESTED-

1. Analytical chemistry- Problems and Solution- S. M. Khopkar, New Age International Publication.
2. Day & Underwood: Quantitative Analysis.
3. Findley: Practical Physical Chemistry:
4. A. I. Vogel A Text book of Quantitative inorganic Chemistry, ELBS, London.
5. Strouts Galfillal: Analytical chemistry
6. Y. Lyalikov: Physicochemical Analysis
7. S. Wilson & P. Jones: Chemical Analysis Vol I
8. Meites and Thomas: Advance Analytical Chemistry. (Mc Graw Hill)
9. H.H. Willard, L.L. Merritt and J.A. Dean: Instrumental Methods of Analysis (Van Nostrand).
10. B. L. Krayner, H. H. Willard. L. Merritt, J. A. Dean & F. A. Settle: Instrumental Methods of Analysis (CBS Publishers, Delhi, 1986)
11. R. D. Brown Instrumental Methods of Chemical Analysis (Mc Graw Hill)
12. L. R. Snyder & C. H. Harvath: An Introduction to Separation Science (Wiley Interscience)
13. F. J. Wicher Robert: Standard Methods Chemical Analysis.
14. G.L. Davis Krupadanam, D. Vijaya Prasad, K. Varaprasad Rao, KLN Reddy, C. Sudhakar, Analytical chemistry.
15. S.M. Khopkar Analytical chemistry of Macrocyclic and supramolecular and compounds, Narosa publication.
16. R. D. Budhiraja Separation Chemistry, New Age.
17. Kaushik & Kaushik Perspectives in Environmental Studies, New Age
18. R.L. Peesok and L.D. Shield: Modern Methods of Chemical Analysis.
19. Data Analysis for Chemistry, D.B. Hibbert, Oxford University Press.
20. Analytical Chemistry, S.P.J. Higson, Oxford University Press

**SEMESER I
Practical - I
Organic Chemistry**

Total Hours: 90 hrs. (9 Hours per week) (26 Laboratory Session)

Total Marks: 100

A- Organic Synthesis: Single Stage Preparations (25 Marks)

(8 Laboratory Session)

- i) Benzaldehyde to cinnamic acid (Perkin Reaction)
- ii) p-nitrobromobenzene from bromobenzene. (Nitration)
- iii) Dibenzal acetone from Benzaldehyde. (Aldol Condensation)
- iv) Anthranilic acid to 2-iodo /2-choro benzoic acid.
- v) m-di-nitrobenzene to m-nitroaniline (Reduction).
- vi) Diel's Alder reaction of anthracene and maleic anhydride.
- vii) Synthesis of dihydropyrimidinone by Green Method (Begenneli reaction)
- viii) Preparation of 1,1-bis-2-naphthol (Radical Coupling Reaction) by Green Synthesis
- ix) Oxidation: Adipic acid by chromic acid oxidation of Cyclohexanol.
- x) Sandmeyer reaction: p- Chlorotoulene from p-Toluidine.

Note:

- i) The preparations should be carried out using (0.02 to 0.05 mole) of the starting material.
- ii) The yield, melting point and TLC of the recrystallized product should be recorded.
- iii) The sample of the purified product and TLC plate should be submitted for inspection.

Scheme of Marking:

- | | |
|---|----|
| i). Yield of the crude product | 10 |
| ii). MP of the recrystallized product | 10 |
| iii). TLC of the recrystallized product | 05 |

B- Qualitative Organic Analysis: (30 Marks)

(10 Laboratory Session)

Separation, purification and identification of binary mixtures. The two components may be solid-solid, solid-liquid or liquid-liquid (nonvolatile). The water soluble solid/liquid should also be given. Student should submit the purified samples of the separated compounds and prepare a suitable derivative of the two compounds separated out.

Note : Analysis of at least ten mixtures should be carried out.

Scheme of Marking:

- | | |
|--|----|
| i) Type of the mixture | 10 |
| ii) Analysis of the individual components: (10 Marks for each component) | |
| a). Detection of Elements | 02 |
| b). Detection of functional groups | 02 |
| c). Determination of MP/BP | 02 |
| d). Preparation of the derivative | 02 |
| e). Identification (Spotting) | 02 |

C - Quantitative Analysis: (25 Marks)

(8 Laboratory Session)

- i) Estimation of Phenol by KBr/KBrO₃
- ii) Estimation of given carbonyl compound by hydrazone formation
- iii) Determination of percentage of number of hydroxyl group in an organic compound by acetylation method.
- iv) Estimation of Aspirin. (Potentiometric/Conductometric)
- v) Estimation of Streptomycin. (Colorimetric)
- vi) Estimation of vit-B12. (Colorimetric)
- vii) Estimation of carbohydrates, amino acids, proteins by UV-Vis spectrophotometer
- viii) Assay of Diazepam by UV-Vis Spectrophotometer
- ix) Assay of Riboflavin by UV-Vis Spectrophotometer.
- x) Determination of Hammett constants and determine its substitution effect. i) Benzoic acid, ii) p-Nitro Benzoic acid, iii) p-Methoxy Benzoic acid, iv) p-Methyl benzoic acid, v) p-Chloro benzoic acid. (Out of two compounds one compound must be benzoic acid and another should be substituted benzoic acid is given to the students)

**Practical-I
Organic Chemistry**

Time : 6-8 Hrs. (One day Examination)

Total Marks : 100

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|--|----------|
| (1) Exercise-1 (Organic Synthesis) - | 25 Marks |
| (2) Exercise-2 (Qualitative Analysis) - | 30 Marks |
| (3) Exercise-3 (Quantitative Analysis) - | 25 Marks |
| (4) Record - | 10 Marks |
| (5) Viva-Voce - | 10 Marks |

Total	-100 Marks
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Books Suggested:

1. Experiments and technique in organic experiments- D. Pasto, C. Johnson and M. Miller prentice Hall.
2. Macro- scale and micro-scale organic experiments-K.L. Williaman, D. C. Heath.
3. Systematic quantitative organic analysis – H. Middleton, Edward Arnold.
4. Hand book organic chemistry – quantitative and qualitative, H. Clark, Edward Arnold.
5. Practical organic chemistry –H. Dupont, Durst and George W. Gokel.
6. Textbook of practical organic chemistry-A.I. Vogel.
7. Qualitative organic Chemical analysis-A.I. Vogel.
9. Experiment organic chemistry Vol.I &II –P.R. Singh, D. S. Gupta and K.S. Bajpai.
10. Vogel' textbook practical organic chemistry – A.R. Tatchell, John Willey.
11. Unitised experiment in organic chemistry-Ray Q Brewalter, Calven, A. Vaudenwerf and William

**Semester I
Practical - II
Physical Chemistry**

Total Hours: 90 hrs. (9 Hours per week)

Total Marks: 100

Use of Computer Programs 5 terms of practicals: Treatment of experimental data, X-Y plots, programs with data preferably from physical chemistry practicals. Students will operate two packages I) MS-Word and II) MS-Excel.

Part-A

- To study the surface tension-concentration relationship for solution and determination of surface excess concentration by using Gibbs' adsorption equation.
- To find out the molecular surface energy and the association factor of ethyl alcohol.
- To study the effect of concentration of an electrolyte (KCl, NaCl) on solubility of an organic acid.
- To study the kinetics of iodine clock reaction.
- To study the reaction between acetone & iodine in presence of acids.
- Determination of CMC of soap by surface tension method.
- To minimize a molecule (ibuprofen of aspirin) so as to obtain a stable conformer and calculation of various molecular properties using quantum mechanical calculations.
- To minimize the water molecule using DFT calculation involving B3LYP basis set.

Part-B

- To measure refractometrically average polarisability of some common solvents.
- To find out the order of reaction and velocity constant of inversion of cane sugar by acid polarimetrically.
- Polarimetric determination of the specific rotation of camphor in benzene and carbon tetrachloride.
- Determination of strength of strong and weak acid in given mixture conductometrically.
- To determine equivalence conductance of strong electrolytes at several concentrations and verification of Debye-Huckel Onsager principle conductometrically.
- To study the complex formation between ferric and salicylic acid and find the formula and stability constant of the complex colorimetrically.
- To determine the dissociation constant of phenolphthalein colorimetrically
- To determine the dissociation constant of Cu (II) and Fe (III) solution photometrically by titrating it with EDTA

**Practical-II
Physical Chemistry**

Time : 6-8 Hrs. (One day Examination)

Marks : 100

Exercise - 1 (Instrumental)	-	40 Marks
Exercise - 2 (Non-Instrumental)	-	40 Marks
Record	-	10 Marks
Viva-Voce	-	10 Marks

Total - 100 Marks

Books Suggested:

- Findley's Practical Physical Chemistry, B.P. Levitt Longman.
- Practical Physical Chemistry, A.M. James and F.F. Prichard Longman.
- Experimental Physical Chemistry, R.C. Das and B. Behra, Tata McGrawHill.
- Advanced Physical Chemistry Experimentals Gurtu-Gurtu Pragati Prakashan
- Experimental Physical Chemistry, V.D. Athanale and Parul Mathur New age International
- Advance Practical Physical Chemistry J.B. Yadao Goel Pubs. House.
- Experimentals in Physical Chemistry by Dr. D.V.Jahagirdhar.
- Experiments in Physical Chemistry by D.P. Shoemaker.
- Systematic experimental Physical Chemistry by Dr. T.K. Chandhekar & S.W. Rajbhoj.

**Semester II
Paper V
Co-ordination Chemistry**

60hrs (4hrs/week). 12hrs/unit

Total Marks 80

Unit-I : A) Electronic spectra:

12L

Introduction of electronic spectra of transition metal complexes. Derivation of term symbols for ground and excited states of d^n configurations, (L-S coupling and j-j coupling), microstates, Types of experimental recording of the spectra, Selection rule for ligand-field and charge transfer transitions in metal complexes, Relaxation in Selection rules, Nature of electronic spectral bands, band widths, Band intensities & factors influencing band shapes (Jahn-Teller Effect-Spectrochemical Series-Nephelauxetic Effect), electronic spectra of transition metal complexes of the type $[M(H_2O)_n]^{n+}$ spin free and spin paired ML_6 complexes of other geometries with suitable examples. Spin forbidden transitions and effect of spin-orbit coupling. Evaluation of D_q , B' and β parameters (Konig method), Numericals. Orgel diagrams (d^1-d^9 states) and Tanabe-Sugano diagrams of d^2 and d^8 configurations of an octahedral environment. Charge transfer spectra & its mechanism, Intensity of charge transfer bands.

B) Magnetochemistry:

Fundamental equations in molecular magnetism, magnetic susceptibility and magnetic moment; diamagnetic and paramagnetic behavior of transition metal complexes of different geometries, factors affecting the magnetic properties, Temperature dependence of paramagnetism(TDP) and temperature independent paramagnetism(TIP) of complexes, High spin-low spin crossover. Abnormal magnetic properties, orbital contributions and quenching of orbital angular momentum, spin-orbit coupling, magnetic interactions, ferromagnetism and antiferromagnetism. Anomalous magnetic moments and magnetic exchange coupling. Magnetic properties of polynuclear complexes. Magnetic moment, electronic spectra and structure of tetrahalocobalt(II) complexes, tetrahedral and octahedral Ni(II) complexes.

Unit-II : Reaction Mechanism of Transition Metal complexes-I: 12L

Classification of Inorganic reactions, Energy profile diagram with terminology includes transition state or activated complex, substrate, attacking reagents electrophilic and nucleophilic. Reactivity of metal complexes, ligand replacement reaction: classification of mechanism and energy profile of reaction. Inert and labile complexes, interpretation of lability and inertness of transition metal complexes on the basis of VBT and CFT. Factors affecting the lability of a complex, transition state or activated complex, substrate, attacking reagents electrophilic and nucleophilic. Kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct & indirect evidences in favour of conjugate mechanism, anation reaction, reaction without metal ligand bond cleavage, reactions of coordinated ligands. Molecular rearrangement complexes. Geometrical, linkage and optical isomerization reactions. Ligand stereospecificity.

Unit-III : Reaction Mechanism of Transition Metal complexes-II: 12L

Substitution reaction in square planar complexes: the trans effect, trans-directing series, cis effect, steric effect, solvent effect, effect of leaving group, effect of charge, effect of nucleophile, effect of temperature. Trans effect theories, uses of trans-effect, mechanism of substitution reactions in Pt(II) complexes. Electron transfer reactions. Types of electron transfer reactions, conditions of electron transfer, and mechanism of one-electron transfer reactions, outer sphere and inner sphere mechanisms, two electron transfer reactions-complimentary and non-complimentary reactions. Tunneling effect, cross-reaction, Marcus-Hush theory, bridged activated mechanism. Synthesis of coordination compounds using electron transfer reactions. Photochemical reaction of Chromium and Ruthenium complexes.

Unit-IV : Metal pi-Complexes: 12L

Metal carbonyls: Structure and bonding, structural elucidation of metal carbonyls (by IR, and ¹³C NMR spectra), important reaction of metal carbonyls. Metal carbonyl clusters with reference to classification, EAN rule, synthesis and structures. Application of Wilkinson's catalyst and Vaska's compound.

Metal nitrosyls: Nitrosylating agents for synthesis of metal nitrosyls, vibrational spectra and X-ray diffraction studies of transition metal nitrosyls for bonding and structure elucidation, important reactions of transition metal nitrosyls, structure and bonding.

Fluxional Organometallic compounds : Fluxionality and dynamic equilibria in compounds such as η^2 -olefin, η^3 -allyl and diene complexes.

Unit-V : Bio-inorganic chemistry: 12L

Bioinorganic chemistry: Overview of Bioinorganic chemistry, biological role of alkali metal ions, ligands, ion transport across the membrane, Classification as enzymatic and non-enzymatic metals, enzymatic redox metals such as Cu(SOD) and enzymatic non redox metals such as Zn(Hydrolase). 5L

Bioinorganic chemistry of Fe: Hemoglobin and myoglobin, their structures and functions, their coordination geometry and electronic structure, trigger mechanism, Introduction of Fe-S proteins, electron transfer proteins: Rubredoxin, 2Fe-2S Ferredoxins, 4Fe-4S and 8Fe-8S proteins Transport protein(transferrin) and storage protein(ferritin), Oxygenation reactions, Hill constant and Bohr Effect. 5L

Bioinorganic chemistry of Co: Vitamin-B₁₂, its structure and biochemical function and mechanisms of action. 2L

Suggested Books

1. J.E.Huheey :Inorganic Chemistry
2. F.A.Cotton& G. Wilkinson: Advanced Inorganic Chemistry 3rd, 5th & 6th Editions.
3. A.F. Willims: Theoretical Approach in inorganic chemistry.
4. Mannas Chanda: Atomic Structure and chemical Bonding
5. L. E. Orgel: An Introduction To transition metal chemistry, Ligand field theory, 2nd Edition.
6. J. J. Logowski: Modern Inorganic Chemistry
7. B.Durrant and P.J.Durrant: Advanced Inorganic Chemistry
8. J C. Bailar: Chemistry of co-ordination compounds.
9. W. L. Jolly: Modern Inorganic Chemistry Jones: Elementry Co-ordination chemistry.
10. B. N. Figgis: Introduction to Ligand field.
11. M.C.Day and J.Selbin: Therotical Inorganic Chemistry.
12. J. Lewin and Wilkins: Modern Co-ordination chemistry.
13. Purcell and Kotz: Inorganic Chemistry.

14. D. Banerjee: Co-ordination chemistry, Tata Mc. Graw. Pub.
15. A.F. Wells: Structural inorganic chemistry, 5th Edition, Oxford.
16. S. G. Davies: Organotransition metal chemistry applications to organic synthesis.
17. R. C. Mehrotra: Organometallic chemistry Tata McGraw Hill. Pub.
18. G. S. Manku: Theoretical principles of inorganic chemistry
19. A. B. P. Lever: Inorganic electronic spectroscopy.
20. R.C.Maurya: Synthesis and characterisation of novel nitrosyls compounds, Pioneer Pub. Jabalpur 2000.
21. R.H.Crabtree: The Organometallic chemistry of Transition metals, John Wiley.
22. D.N.Styanaryan: Electronic Absorption Spectroscopy and related techniques, University Press.
23. R. S. Drago: Physical methods in inorganic chemistry
24. F.Basolo & G.Pearson: Inorganic Reaction Mechanism
25. Organometallics II & I complexes with transition metal- carbon bonds: Manfred Bochmann- Oxford Press.
26. Advanced Inorganic Chemistry Vol I & II – Satyaprakash, Tuli, Bassu and Madan- S Chand.
27. M.Tsusui, M.Nlevy, M.Ichikwa and K.Mori: Introduction to metal pi-complex chemistry, Plenum press, NY
28. A.E.Martel; Coordination Chemistry-Vol I & II, VNR.

Paper VI
Organic Chemistry – II

60hrs (4hrs/week). 12hrs/unit

Total Marks 80

Unit-I : A) ADDITION TO C-C & C-X MULTIPLE BOND

12L

Mechanistic and stereo chemical aspects of addition reaction involving electrophiles, nucleophiles and free radicals, Orientation and stereochemistry, Addition to cyclopropanes, hydroboration, oxymercuration, Michael reaction, Aldol Condensation (Stereochemistry), Knoevenagel reaction, Hydrolysis of esters and amide

B) MECHANISM OF MOLECULAR REARRANGEMENT

Classification and General mechanistic treatment of electrophilic, nucleophilic and free radical molecule rearrangement. Mechanism of the following rearrangement –

- a) Rearrangement to electron deficient carbon: Wagner-Meerwin, Pinacol-Pinacolone, Tiffenev – Demjnov ring expansion,
- b) Rearrangement to electron rich carbon: Neber and Steven's rearrangement
- c) Rearrangement to electron deficient nitrogen: Beckman, Hoffman, Curtis, Lossen, Schmidt rearrangement.

Unit-II : FREE RADICAL REACTION :

12L

Radical anions and radical cations, Types of free radical reactions, free radical substitution mechanism at an aromatic substrate, aliphatic substrate, reactivity at a bridgehead position. Neighbouring group assistance, reactivity for aliphatic and aromatic substrates, reactivity in attacking radicals, effect of solvent on reactivity at allylic carbon, hydroxylation at an aromatic carbon by means of Fenton's reagent. Oxidation of aldehydes to carboxylic acids. Chlorosulphoration (Reed Reaction) Coupling of alkynes and arylation of aromatic compounds by Diazonium salts. Sand Meyer reaction, Free radical rearrangement, Hunsdiecker reaction. Singlet oxygen, its generation and reactions with organic substrates, Barton Deoxygenation, McMurry Coupling.

Unit III : Photochemistry :

12L

Interaction of radiation with matter, types of excitation, rate of excited molecules, quenching, Quantum efficiency, quantum yield, transfer of excitation energy, actinometry, Photoinduced energy transfer, FRET, singlet and triplet states, experimental methods in photochemistry of carbonyl compounds, and transition, Norrish type I and Norrish type II reactions Paterno –Buchi reaction, Photoreduction, Photochemistry of enones, Hydrogen abstraction rearrangement of unsaturated ketones and cyclohexadienones, Photochemistry of parabenzoquinones, (di- π methane) Photochemistry of Aromatic compounds with reference to isomerisation addition and substitution Photochemical isomerization of cis and trans alkenes, Photochemical cyclization of reaction, Photo-Fries rearrangement, Photo theory reaction of anilides, Fluorescence based sensor, Conversion of solar energy to chemical and other form of energies, Solar Photo Voltaic Cell.

Unit—IV : Pericyclic Reactions

12L

Molecular orbital symmetry, Frontier orbitals of ethylene, 1, 3-butadiene, 1, 3, 5-hexatriene, allyl system, classification of pericyclic reaction. FMO approach, Woodward-Hoffman correlation diagram method and Perturbation of molecular orbital (PMO) approach of pericyclic reaction under photochemical conditions. Electrocyclic reactions, conrotatory and disrotatory motion $4n$ and $(4n+2)$ systems, with more emphasis on $(2+2)$ and $(4n+2)$ Cycloaddition of ketones Secondary effects in $(4+2)$ cycloaddition. Stereochemical effects and effect of substituents on rate of cycloaddition reaction, 1,3-dipolar cycloaddition and chelotropic reaction. Sigmatropic rearrangement, suprafacial and antarafacial shift involving carbon moieties, retention and inversion of configuration, $(3,3)$ and $(3,5)$ sigma tropic rearrangements, Claisen and Cope rearrangements, Ene reaction, Fluxional Tautomerism, Sigmatropic Migration of Carbon.

Unit-V : GREEN CHEMISTRY : **12L**
 Designing a green synthesis: Choice of starting material, choice of solvents. Basic principle of green chemistry: Prevention of waste by products, Maximum incorporation of the reactants (starting material and reagents) into the final products. Rearrangements reaction, Addition reaction, substitution, elimination reaction, Prevention or minimization of hazardous products. Designing of safer chemical. Synthesis involving basic principles of green chemistry, some examples-Synthesis of styrene, Synthesis of urethane, Free radical bromination ,Synthesis of paracetamol, Synthesis of Ibuprofen.
 Microwave induced green synthesis: Oxidation of Toluene, Synthesis of Chalcones, Fries rearrangement, Diels Alder reaction, Hydrolysis of benzyl chloride. Aqueous phase reactions: Heck reaction, Benzoin condensation, Michael Reaction Bio Catalyst in organic synthesis, Ionic Liquids as Green Solvents.

Books Suggested-

1. Advanced organic chemistry –Reaction mechanism and structure. Jerry March, John Wiley.
2. Advanced organic chemistry- F.A. Carey and R.J. Sunberg, Plenum.
3. A Guidebook to mechanism in organic chemistry-Peterskyes, Longman.
4. Structure and mechanism in organic chemistry-C.K. Gold, Cornell University Press.
5. Organic chemistry, R.T. Morrison Boyd. Prentice Hall
6. Modern organic chemistry-H.O. House, Benjamin.
7. Principal of organic chemistry-R.O.C. Norman and J.M. Coxon, Blackie Academic and Professional.
8. Reaction mechanism in organic chemistry-S.M. Mukharji and S.P. Singh, Macmilan.
9. Stereochemistry of organic compounds- D. Nasipuri, New age international.
10. Stereochemistry of organic compounds- P.s.kalsi, New age international.
11. Frontier orbitals and organic chemical reactions-I. Fleming.
12. Orbital Symmetry – R.E.Lehr & A.P. Marchand.
13. Reactive intermediate in organic chemistry-N. S. Isaacs.
14. Stereochemistry of carbon compounds- E.L.Eliel.
15. Physical organic chemistry-J. Hine.
16. Name reaction in organic chemistry –Surrey.
17. Advanced organic chemistry – L.F.Fieser and M. Fieser.
18. Vol.I & II organic chemistry - I. L. Finar.
19. Modern organic chemistry- J.D. Roberts and M. C. Caserio.
20. The search for organic reaction pathways (Longmann), Peter Skyes.
21. Organic chemistry 5th Edition (McGraw Hill), Pine.
22. Organic chemistry (Willard Grant Press Botcon), John Mcurry.
23. A Textbook of organic chemistry- R.K. Bansal.
24. New trends in green chemistry –V.K. Ahluwalia & M. kidwai, Anamaya publishers New Delhi.
25. Fundamentals of photochemistry-KK Rohatgi & Mukharji
26. Photochemistry-Cundau & Gilbert
27. Aspects of organic phoptochemistry-WM horspoot
28. Photochemistry-JD calvert
29. Photochemistry-RP Wayne R. M. Acheson : An introduction to chemistry of heterocyclic compounds (Interscience).
30. Pericyclic Reactions and organic photochemistry
31. Green Solvents for organic synthesis: V. Ahluwalia& R. S. Verma
32. Eco Friendly Synthesis of fin Chemicals: Roberto Ballini
33. Essentials of molecular photochemistry, A. Gilbert and J. Baggott. Blackwell Scientific Publication.
34. Molecular photochemistry, N.J. Urro, W. A. Benjamin

**Paper - VII
Physical Chemistry - II**

60hrs (4hrs/week). 12hrs/unit

Total Marks 80

Unit-I : Chemical Dynamics :
 A) Kinetics of Complex reactions: Chain reaction (H_2+Br , @ 2 HBr thermal and photo chemical reaction), Homogeneous catalysis (acid-base and enzymes), oscillating reactions (Belousov-Zhabotinsky reaction, Lotka-Volterra mechanism, the brusselator and the oregonator). 6L
 B) Fast reactions: General features of fast reactions, Stopped flow method, relaxation method, Nuclear magnetic resonance method, Flash Photolysis, Numericals. 6L

Unit-II : Quantum Chemistry :
 A) Construction of M.O.by LCAO for H_2^+ ion, Calculation of energy levels from wave functions, physical picture of bonding & anti-bonding wave functions, concept of orbitals and their characteristics. 6L
 B) Hybride orbitals sp , sp^2 , sp^3 ;Calculationof coefficient of A.O. used in hybride orbital;Huckel theory of Conjugated systems, bond order & charge density calculations. Applications to ethylene, butadiene, cyclopropenyl radical, cyclo- butadiene. Numericals. 6L

Unit-III : Macromolecules:

A) Definition of macromolecule (Polymer), types of polymers, Random coils, configuration and conformation of macromolecules, electrically conducting molecular wires, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization. stability of biological polymers, Application of polymers. 6L

B) Number average & mass average molecular mass, molecular mass determination by Osmometry, Viscometry, Ultracentrifugation, light scattering & size-exclusion chromatography method, Numericals 6L

Unit-IV : Electrochemistry :

A) Electrochemistry of solutions: Debye-Huckel-Onsager treatment and its extension. Ion solvent interactions.. Bio-electrochemistry, Introduction, threshold membrane phenomenon, Nernst - Plank Equation, Hodges Huxley equation, core conductor models, electrocardiography. 6L

B) The rate of charge transfer, the Butler-Volmer equation, the low overpotential limit the high overpotential limit, Tafel plot. Voltammetry, Concentration polarization, experimental techniques, corrosion, Types of corrosion, corrosion inhibitors , Corrosion monitoring. and prevention methods. Numericals. 6L

Unit-V : Statistical Thermodynamics :

A) Thermodynamic probability, most probable distribution. Maxwell-Boltzmann distribution law Fermi-Dirac statistics, distribution law and applications to metals. Bose-Einstein statistics - distribution law and application to helium. 6L

B) Partition function- Translational, rotational, vibrational and electronic partition functions, calculations of thermodynamic properties in terms of partition functions. Applications of partition functions. Numericals. 6L

List of Books:

1. Physical chemistry by P.W. Atkins & dePaula 7th Edition
2. Molecular reaction Dynamics and chemical reactivity, R.D. Levine and R.B. Benstin, Oxford University Press. 1987.
3. Physical Chemistry by Alberty and Silby, Jolly Wiley
4. Adsorption and Catalysis by solids, by D.K. Chakraborti, Wiley Eastern, 1990
5. The Theory of Adsorption and catalysis, by A. Clark, Academic press, 1970
6. Micells Theoretical and applied aspects, by V. Moroy. Plenum
7. Modern Electrochemistry by A.K.N. Raddy
8. Theoretical electrochemistry by D.L. Antropov, Mir Publisher WJ2
9. Electrochemistry by J. Dvorak, J. Koryta, V. Bohackova.
10. Introduction to radiation chemistry by J.W.T. Spinks and R.J. Woods

Paper VIII**Optical Methods and Environmental Chemistry****60hrs(4hrs/week), 12hrs/Unit****80Marks****Unit-I : Optical Method****12L**

Spectrophotometry and Colorimetry: Brief introduction of topic, Application of spectrophotometric methods for study of composition of coloured complex, Multiple analysis, Pk value of indicator etc. Photometric titrations. Applications of quantitative and qualitative analysis, problems.

Principles, Plane polarized and circularly polarized rays, optical rotation, optically active molecules, optical rotator
Theory, instrumentation and applications of fluorimetry, Nephelometry, turbidimetry, Polarimetry & Refractometry.

Unit II : Flame Emission and atomic spectrometry:**12L**

Flame photometry: Elementary theory of flame photometry. Instrumentation and experimental techniques. Interferences, analytical techniques and applications. Atomic absorption spectrometry (AAS): introduction, principles, Advantages of AAS over FES, Instrumentation, Flame atomization. Hollow cathode lamps, interferences and applications. Comparison of atomic absorption with atomic emission methods.

UNIT-III : WATER POLLUTION :**12L**

Origin of wastewater, types, water pollutants and their effects. Sources of water pollution, domestic, industrial, agricultural soil and radioactive wastes as sources of pollution. Objective of analysis, parameter for analysis colour, turbidity, total solid, conductivity, acidity, alkalinity, hardness, chloride, sulphate, fluoride, silica, phosphates and different forms of nitrogen. Heavy metal pollution, public health significance of Cadmium, Chromium, Copper, zinc Lead, Manganese, Mercury and Arsenic. General survey of instrumental technique for the analysis of heavy metals in aqueous systems. Oxygen content of water and aquatic life. Measurements of DO, BOD, COD and their significance as pollution indicators. Pesticides as water pollutants and analysis. A brief idea of coagulation and flocculation.

Unit IV : AIR POLLUTION**12L**

Sources and sinks of gases pollutants, classification of air pollutants, effect of air pollutants on living and non-living things. Sources of air pollution, air quality standards and sampling. Analysis of air pollutants (CO, CO₂, NO_x, SO_x, H₂S, NH₃ and Hydrocarbons and particulates). Green house effect, acid rain, ozone depletion and their consequences on environment. Effects of air pollution, photochemical smog and monitoring of air pollution.

Unit-V : Soil Pollution and Pesticide Analysis **12L**
 Chemistry of soil, soil irrigation by effluents. Agricultural pollution, role of micronutrients in soil, trace element analysis in soil
 Pesticides and pollution. Sources of pesticide residue in the environment, classification of pesticides, pesticide degradation by natural forces, effect of pesticide residue on life. Analytical techniques for pesticide residue analysis. DDT problem.
Radiation pollution—Classification and effects of radiation. Effects of ionizing radiation on Man. Effect of nonionizing radiation on life. Radioactivity and nuclear fall out, protection and control from radiation.

List of Books

1. Analytical chemistry- Problems and Solution- S. M. Khopkar, New Age International Publication.
2. Day & Underwood: Quantitative Analysis.
3. Findley: Practical Physical Chemistry:
4. Vogel A Text book of Quantitative inorganic Chemistry, ELBS, London.
5. Strouts Galfillal: Analytical Y. Lyalikov: Physocochemical Analysis
6. S. M.Khopkar:Basic concep in Analytical Chemistry
7. Meites and Thomas: Advance Analytical Chemistry. (Mc Graw Hill)
8. **H.H.Willard ,L.L.Merritt and J.A.Dean: Instrumental Methods of Analysis (Van Nostrand).**
9. **B. L. Kraye, H. H. Willard. L. Merrit, J. A. Dean & F. A. Settle: Instrumental Methods of Analysis (CBS Publishers, Delhi, 1986)**
10. R. D. Brown Instrumental Methods of Chemical Analysis ,McGraw Hill
11. **L. R. Shyder & C. H. Harvath: An Introduction to Separation Science (Wiley Interscience).**
12. **Environmental chemistry, S. E. Manahan, Lewis Publishers.**
13. Environmental chemistry, Sharma & Kaur, Krishna publishers.
14. Environmental chemistry, A. K. De, Wiley Eastern.
15. Environmental Pollution Analysis, S. M. Khopkar, Wiley Eastern.
16. Environmental Toxicology, Ed. J. Rose, Gordon and Breach Science Publication.
17. Elemental Analysis of Airborne Particles, Ed. S. Landberger and M. Creatchman, Gordon and breach Science Publication.
18. Atmospheric pollution, W. Buch, McGraw Hill, New York.
19. Fundamentals of Air Pollution, S. J. Williason, Addison – Wesley Publishers.
20. Analytical Aspect of Environmental chemistry, D. F. S. Natush and P. K. Hopke. John Wiley & sons. New York.
21. Analytical chemistry- Problems and Solution- S. M. Khopkar, New Age.
22. Environmental Chemistry, J.W.Vanloon, Oxford University Press.
23. E. Stocchi: Industrial Chemistry, Vol-I, Ellis Horwood Ltd. UK.
24. R.M. Felder, R.W. Rousseau: Elementary Principles of Chemical Processes, Wiley Publishers, New Delhi.
25. J. A. Kent: Riegel’s Handbook of Industrial Chemistry, CBS Publishers, New Delhi.
26. S. S. Dara: A Textbook of Engineering Chemistry, S. Chand & Company Ltd. New Delhi.
27. K. De, Environmental Chemistry: New Age International Pvt., Ltd, New Delhi.
28. S. M. Khopkar, Environmental Pollution Analysis: Wiley Eastern Ltd, New Delhi.
29. S.E. Manahan, Environmental Chemistry, CRC Press (2005). • G.T. Miller, Environmental Science 11th edition. Brooks/ Cole (2006).
30. A. Mishra, Environmental Studies. Selective and Scientific Books, New Delhi (2005).

**Semester II
 Practical - III
 Physical Chemistry**

Total Hours: 90 hrs. (9 Hours per week)

Total Marks: 100

Use of Computer Programs 5 terms of practicals:

Treatment of experimental data, X-Y plots, programs with data preferably from physical chemistry practicals. Students will operate two packages I) MS-Word and II) MS-Excel.

Part-A

1. Determination of radius of molecules of glycerol by viscometry.
2. Determine the viscosity of unknown mixture of two liquids by viscometry (ethyl alcohol + water)
3. Study the influence of ionic strength on the solubility of CaSO₄ and hence to determine thermodynamic solubility product and mean ionic activity.
4. Determine rate constant of reaction between potassium persulphate and potassium iodide having equal concentration of reacting species.
5. Investigate the autocatalysis reaction between KMnO₄ and oxalic acid and calculate the energy of activation.
6. Investigate the solubility of three component system and hence draw a tie line on binodal curve.
7. Study the variation of solubility of Ca(OH)₂ in pressure of NaOH solution. Hence determine solubility product at room temperature.
8. Determination at surface excess of amyl alcohol by capillary rise method.
9. **Part-B**
10. Determine Hammett constant of a given substituted benzoic acid by pH measurement.
11. To determine the hydrolysis constant of active hydrochloride by pH measurement.
12. To determine pH of butter solution using quinhydrone electrode.
13. Determination of pK value of acid-base indicator (methyl red, methelene blue and bormo cresol) by spectrophotometrically.
14. Determination of standard electrode potential of Zinc and Copper.
15. To find the strength of HCl and Acetic acid in given mixture potentiometrically.
16. To find the strength of mixture of halides by titrating it against AgNO₃ solution potentiometrically.
17. To determine the hydrolysis constant of aniline chloride by emf method.

**Practical-III
Physical Chemistry**

Time : 6-8 Hrs. (One day Examination)		Marks : 100
Exercise - 1 (Based on Part-A)	-	40 Marks
Exercise - 2 (Based on Part-B)	-	40 Marks
Record	-	10 Marks
Viva-Voce	-	10 Marks

Total	-	100 Marks

Physical Chemistry Practical

Books Suggested:

- 1) Experimental physical chemistry, R.C. Das and B. Behera, Tata McGraw-Hill
- 2) Advanced physical chemistry J.B. yadao, Goel Pub House
- 3) Experiments in physical Chemistry D.P. Shormaker, C.W. Garland and J.W. mbler, Tata McGraw Hill Comp.
- 4) Post graduate physical chemistry, Patel, Turakhia, Kelkar, Himalaya Pub House
- 5) Experiments, in physical chemistry, D.V. Jahagirdar, Himalaya Pub House
- 6) Practical Physical Chemistry, A. Findlay Revised by J.A. Kitehner, Longmans, Green
- 7) Experiments in Physical Chemistry, F. Daniels and J. Williams, Mc Graw Hill.
- 8) Systematic Experimental Physical Chemistry, T.K. Chondekar & S.W. Rajbhoj, Anjali Pub. Aurangabad.
- 9) Advanced Physical Chemistry Experiments, J.N. Gurtu & A. Gurtu, Pragati Prakashan
- 10) Practical Physical Chemistry, A.M. James & P.E. Prichard, Longam Group Ltd.
- 11) Experiments in physical Chemistry, J.M.Wilson, KJ.Newcombe, A.R. Denko, and R.M.W.Richett, Pergamon Press,
- 12) Senior Practical Physical Chemistry, B.D.Khosle and V.S. Garg S.Chand & Comp.

**Semester II
Practical IV
Inorganic Chemistry Practicals**

Practical Work load 9 Hrs. /Week

Marks 100

I] Preparation of inorganic compounds by greener methods and their characterization by elemental analysis, MW determination, decomposition temperatures and molar conductance studies. (Minimum 9)

1. [VO (acac)₂]
2. Preparation of bis(acetylacetonato)copper(II).
3. Preparation of tris (acetylacetonato) iron (III).
4. Preparation of tris (acetylacetonato) manganese (III).
5. *Cis* K [Cr (C₂O₄)₂(H₂O)₂]
6. Na [Cr (NH₃)₂(SCN)₄]
7. K₃ [Fe (C₂O₄)₃]
8. Hg [Co (SCN)₄]
9. [Co (Py)₂ Cl₂]
10. [Ni (DMG)₂]
11. TiO (C₉H₈NO)₂(H₂O)₂
12. *Cis* [Co (trine)(NO₂)₂] Cl H₂O
13. [Cu₂ (CH₃COO)₄(H₂O)₂]
14. K₃ [Al (C₂O₄)₃](H₂O)₃
15. Preparation and characterization of Isomers of Tris (8-Hydroxyquinolino) aluminium (III) complex

II] A) Quantitative Analysis of mixture of two cations:

Quantitative analysis of binary mixture of cations involving their chemical separation and separate analysis of one cation by gravimetry and another by volumetric or colorimetric. Certain model examples are given below:

- i) Copper (II) and Nickel (II)
- ii) Copper (II) and Zinc (II)
- iii) Nickel (II)—Zinc (II)
- iv) Copper (II)—Iron (III)

B) Analysis of Limestone, Dolomite and Bauxite.

III] Qualitative analysis of radicals

Qualitative analysis of inorganic mixture for a total of five radicals including interfering radicals (not more than one such radical in a mixture), rare earth (not more than two rare earths in a mixture) and combination of cations (minimum 8 mixtures).

Cations: Mercury (I, II), Pb, Ag, Bi (III), Cu (II), Cd (II), As (IV, V), Sb (IV, V), Sn (II, IV), Fe (III), Al (III), Cr (III), Ni (II), Co (II), Mn (II), Zn (II), Barium, Strontium, Calcium and Magnesium.

Interfering radicals: Phosphate, Oxalate, Fluoride and Borate.

Rare Earth: Tl, Mo, W, Se, Ti, Zr, Th, V, U, Ce.

The Practical examination will be based on the Inorganic Chemistry.

Time: 6-8 hours (one day examination) Marks: 100

I) Exercise -1 (Synthesis/Radicals)	- 40 Marks
II) Exercise-2 (Estimation)	- 40 Marks
III) Record	- 10 Marks
IV) Viva- Voce	- 10 Marks
<hr/>	
Total	-100 Marks

Books Suggested-

1. Synthesis and Characterization of Inorganic Compounds, W. L. Jolly, Prentice Hall.
2. Inorganic Experiments, J. Derck Woollins, VCH.
3. Practical Inorganic Chemistry, G. Marrant, B. W. Rockett, Van Nostrand.
4. A Text Book of Quantitative Inorganic Analysis, A. I. Vogel
5. EDTA Titrations. F. Laschka
6. Instrumental Methods of Analysis, Willard, Merit and Dean (CBS, Delhi).
7. Inorganic Synthesis, Jolly
8. Instrumental Methods of Chemical Analysis, Yelri Lalikov
9. Fundamental of Analytical Chemistry, Skoog D.A. & West D.M Holt Rinehart & Winston Inc.
10. Experimental Inorganic Chemistry, W.G.Palmer, Cambridge.

अधिसूचना

क्र. : ३०/२०१७

दिनांक : २७/४/२०१७

विषय :- अल्पसंख्याक दर्जा..

सर्व सामान्यांच्या माहिती करिता अधिसूचित करण्यात येते की, महाराष्ट्र शासन सक्षम प्राधिकारी तथा अपर मुख्य सचिव अल्पसंख्याक विकास विभाग, मंत्रालय, मुंबई क्र. अशैसं-२०११/प्र.क्र. १००/२०११/का-५, दिनांक २१/०५/२०१२ व महाराष्ट्र शासन निर्णय क्र. अशैसं-२००८/प्र.क्र. १३३/२००८/का-१, दिनांक ४ जुलै, २००८ च्या अधिनराहून खालील तक्तातील रकाना क्र. २ मधील उल्लेख केलेल्या संस्थेद्वारे संचालित, रकाना क्र. ३ मध्ये उल्लेख केलेले महाविद्यालयास रकाना क्र. ६ मध्ये उल्लेखिलेल्या शासन निर्णयानुसार रकाना क्र. ४ व ५ मधील उल्लेख केल्याप्रमाणे अल्पसंख्यांक दर्जा प्रकार अनुक्रमांक १ प्रमाणे सदर संस्थेच्या महाविद्यालयाला विषय क्र. १६ दि. १२.०४.२०१४ नुसार विद्वत परिषदेने दि. ०७.०१.२०१४ पासून (धार्मिक जैन) असा अल्पसंख्याक दर्जा मान्य केलेला आहे. परंतु प्राचार्यांनी शैक्षणिक सत्र २०११-२०१२ पासून अल्पसंख्याक दर्जा मान्य करण्याची विनंती केलेली असल्यामुळे दि. १३.०७.२०१६ च्या विद्वत परिषदेसमोर मुद्दा क्र. ४६ विचारार्थ ठेवण्यात आला होता. विद्वत परिषदेने सदर महाविद्यालयास शैक्षणिक सत्र २०११-२०१२ पासून अल्पसंख्याक देण्याची बाब मान्य केलेली आहे. अनुक्रमांक २, ३ व ४ प्रमाणे सदर संस्थेच्या महाविद्यालयाला विषय क्र. ४५ दि. १३.०७.२०१६ नुसार विद्वत परिषदेने अल्पसंख्याक दर्जा मान्य केलेला आहे. अनुक्रमांक ५ व ६ प्रमाणे सदर संस्थेच्या महाविद्यालयाला विषय क्र. ८१ दि. १७.१०.२०१६ नुसार विद्वत परिषदेने अल्पसंख्याक दर्जा मान्य केलेला आहे.

अ. क्र.	संस्थेचे नाव	महाविद्यालयाचे नाव	अल्पसंख्याक दर्जा प्रकार धार्मिक / भाषिक		अल्पसंख्याक दर्जा दिलेल्या आदेशाचा क्रमांक व दिनांक
१	२	३	४	५	६
१	श्री वर्धमान जैन एज्युकेशन अँड रिसर्च मल्टीपरंपज फाउंडेशन, अलंकार भगवान महावीर मार्ग, नांदुरा जि. बुलढाणा	श्रीमती तुळशीबाई रंगलालजी झांबड वरिष्ठ महाविद्यालय, आंदन नगर, बुलढाणा रोड, नांदुरा (रेल्वे) जि. बुलढाणा	जैन		१) महाराष्ट्र शासन सक्षम प्राधिकारी तथा अपर मुख्य सचिव अल्पसंख्याक विकास विभाग, मंत्रालय, मुंबई क्र. अशैसं-२०११/प्र.क्र. १००/२०११/का-५, दिनांक २१/०५/२०१२ २) अल्पसंख्याक विकास विभाग महाराष्ट्र शासन निर्णय क्र. अशैसं-२००८/प्र.क्र. १३३/२००८/का-१, दिनांक ४ जुलै, २००८

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२	भारतीय सेवा सदन, के/ऑफ आर.डी.जी. कॉलेज फॉर वुमेन्स, मुर्तीजापूर रोड, अकोला.	श्रीमती राधादेवी गोयनका महिला महाविद्यालय, अकोला.	मारवाडी		१) महाराष्ट्र शासन सक्षम प्राधिकारी तथा सहसचिव अल्पसंख्यांक विकास विभाग, मंत्रालय, मुंबई. क्र.अशैस-२०१६/प्र.क्र.०८७/२०१६/का-५ दि.२१/३/२०१६. २) अल्पसंख्यांक विकास विभाग महाराष्ट्र शासन निर्णय क्र. अशैस.- २०१२/प्र.क्र.२१/का.५, दिनांक २७.५.२०१३. (शैक्षणिक वर्ष-२०१५-२०१६)
३	अल-फलाह एज्युकेशन सोसायटी, खामगांव जि. बुलढाणा.	अब्दुल समद कॉलेज ऑफ एज्युकेशन (बी.एड.) कंजारा, ता. खामगांव.जि. बुलढाणा.	मुस्लिम	उर्दू	१) महाराष्ट्र शासन शालेय शिक्षण व क्रिडा विभाग, शासन निर्णय क्र.एसएमसी १००५/७८/२००५)/असंक. मंत्रालय विस्तार भवन मुंबई दि. १ जुलै, २००५. (शैक्षणिक वर्ष-१ जुलै, २००५.)
४	नुरजहाँ बेगम चॅरिटेबल ट्रस्ट, वणी.जि.यवतमाळ.	नुरजहाँ बेगम सलाम अहेमद वुमेन्स कॉलेज ऑफ लॉ बुरांडा ता.मारेगांव, जि.यवतमाळ.	मुस्लिम	उर्दू	१) महाराष्ट्र शासन सक्षम प्राधिकारी तथा प्रधान सचिव अल्पसंख्यांक विकास विभाग, मंत्रालय, मुंबई. क्र.अशैस-२००९/११७४/ प्र.क्र.३९/२००९/का-१ दि.२७/१/२०१०. (शैक्षणिक वर्ष-२००९-२०१०)
५	मौलाना अबुल कलाम आझाद एज्युकेशन अँड वेलफेअर सोसायटी, धाड ता. जि. बुलढाणा.	मौलाना अबुल कलाम आझाद मराठी बी.एड. कॉलेज, बोरखेड रोड, ता. जि. बुलढाणा.	मुस्लिम	उर्दू	१) महाराष्ट्र शासन शालेय शिक्षण विभाग शासन निर्णय क्र. SMC/१००४/(१९७/२०१४) असंक दि. २४ ऑगस्ट, २००४. २) Governemnt Dcision No. <u>S.M.C.-1004@(197/2004)MC.</u> दि. २४ ऑगस्ट, २००४.
६	बोधीसत्व बहुउद्देशीय शिक्षण संस्था, व्दारा अनिल इंगळे, सिव्हील लार्डन, सर्कीट हाउस समोर वाशिम, जि.वाशिम.	एल.एन. कला महाविद्यालय, वाडेगांव, ता.बाळापूर, जि.अकोला.		बौध्द	१) महाराष्ट्र शासन निर्णय क्रमांक अशैस-२०१०/प्र.क्र.१००/२०१०/का-५ दि.२२/०२/२०१२. २) महाराष्ट्र शासन निर्णय क्र.अशैस.-२००८/प्र.क्र.१३३/२००८.का.१, दिनांक ०४ जुलै २००८.

स्वा/-
कुलसचिव,
संत गाडगे बाबा अमरावती विद्यापीठ
