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संत गाडगे बाबा अमरावती विद्यापीठ

SANT GADGE BABA AMRAVATI UNIVERSITY

PROSPECTUS  
FOR  
DIPLOMA EXAMINATIONS, 2015  
in  
i) Bioinformatics  
ii) Soil & Water Analysis



2014

Price Rs...../-

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Diploma in i) Bioinformatics, ii) Soil and Water Analysis  
(Prospectus No.20151219)

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**SANT GADGE BABA AMRAVATI UNIVERSITY****SPECIAL NOTE FOR INFORMATION OF THE STUDENTS**

- (1) Notwithstanding anything to the contrary, it is notified for general information and guidance of all concerned that a person, who has passed the qualifying examination and is eligible for admission only to the corresponding next higher examination as an ex-student or an external candidate, shall be examined in accordance with the syllabus of such next higher examination in force at the time of such examination in such subjects papers or combination of papers in which students from University Departments or Colleges are to be examined by the University.
- (2) Be it known to all the students desirous to take examination/s for which this prospectus has been prescribed should, if found necessary for any other information regarding examinations etc., refer the University Ordinance Booklet the various conditions/provisions pertaining to examination as prescribed in the following Ordinances.
- Ordinance No. 1 : Enrolment of Students.
- Ordinance No. 2 : Admission of Students
- Ordinance No. 4 : National cadet corps
- Ordinance No. 6 : Examinations in General (relevant extracts)
- Ordinance No. 18/2001 : An Ordinance to provide grace marks for passing in a Head of passing and Improvement of Division (Higher Class) and getting Distinction in the subject and condonation of deficiency of marks in a subject in all the faculties prescribed by the Statute NO.18, Ordinance 2001.
- Ordinance No. 9 : Conduct of Examinations (relevant extracts)
- Ordinance No. 10 : Providing for Exemptions and Compartments
- Ordinance No. 19 : Admission of Candidates to Degrees.
- Ordinance No. 109 : Recording of a change of name of a University student in the records of the University.
- Ordinance No. 138 : For improvement of Division/Grade.

Ordinance No.19/2001 : An Ordinance for Central Assessment Programme, Scheme of Evaluation and Moderation of answerbooks and preparation of results of the examinations, conducted by the University, Ordinance 2001.

**Dineshkumar Joshi**

Registrar

Sant Gadge Baba Amravati University.

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**PATTERN OF QUESTION PAPER ON THE UNIT SYSTEM**

The pattern of question paper as per unit system will be broadly based on the following pattern.

- (1) Syllabus has been divided into units equal to the number of question to be answered in the paper. On each unit there will be a question either a long answer type or a short answer type.
- (2) Number of question will be in accordance with the unit prescribed in the syllabi for each paper i.e. there will be one question on each unit.
- (3) For every question long answer type or short answer type there will be an alternative choice from the same unit. However, there will be no internal choice in a question.
- (4) Division of marks between long answer and short answer type question will be in the ratio of 40 and 60.
- (5) Each short answer type question shall contain 4 to 8 short sub question with no internal choice.

**Ordinance No.10 of 2006****Examinations leading to the Diploma courses in the Faculty of Science, Ordinance, 2006.**

Whereas it is expedient to make an Ordinance in respect of Examinations leading to the Diploma courses in the Faculty of Science, Ordinance, 2006, for the purposes hereinafter appearing the Management Council is hereby pleased to make the following Ordinance.

- 1) This Ordinance may be called, "Examinations leading to the Diploma courses in the Faculty of Science, Ordinance, 2006."
- 2) This Ordinance shall come into force w.e.f. the date of its passing by the Management Council.
- 3) The examinations leading to the Diploma courses in the faculty of Science shall be conducted in following subjects-
  - i) Bioinformatics, and
  - ii) Soil and Water Analysis
- 4) The examinations leading to the Diploma courses as mentioned in para "3." above shall be held twice a year at such places and on such dates as may be appointed by the Board of Examinations.
- 5) The duration of these courses shall be one academic year.
- 6) A) Subject to compliance with the provisions of this Ordinance and of any ordinances in force from time to time, -
  - i) An applicant for admission to the Diploma in Bioinformatics Examination shall have passed a Bachelor's Degree in Science with Biochemistry, Botany, Chemistry, Electronics, Environmental Science, Genetics, Life Science, Mathematics, Microbiology, Physics, Statistics, Zoology as one of the subjects or Bachelor of Science (Agri), or Bachelor of Computer Science, or Bachelor of Engineering, or Bachelor of Medicine & Bachelor of Surgery, or Bachelor of Pharmacy, or Bachelor of Technology or Bachelor of Veterinary Science.
  - ii) Student should have first class (50%) or "A" grade at their graduation from any recognised University.
- B) Subject to compliance with the provisions of this Ordinance and of any other ordinance in force from time to time an applicant for admission to the Diploma in Soil & Water Analysis Examination shall have passed the B.Sc. degree of this University or of any other university recognized as equivalent thereto, with Chemistry or B.Sc. with agricultural science or B.Pharm.

- 7) Without prejudice to the other provisions of Ordinance No.6, relating to the Examinations in General, the provisions of paragraphs 5,8,10 and 32 of the said Ordinance shall apply to every collegiate candidate.
- 8) The fee for the examination shall be as prescribed and notified by the University from time to time.
- 9) A) The examination shall consist of written papers, practicals, project work and viva-voce.  
B) Question papers for the examinations shall be set in English.  
C) The medium of instruction for the courses of study and of the Examinations shall be English.
- 10) The scope of the subjects shall be as indicated in the syllabi.
- 11) The maximum marks for each paper, practicals, project work and viva-voce and the minimum marks which an examinee must obtain in order to pass the examinations shall be as indicated in **Appendices-A & B** respectively appended with this Ordinance.
- 12) Provisions of Ordinance No.18 of 2001 relating to an Ordinance to provide grace marks for passing in a head of passing and Improvement of Division (Higher class) and getting Distinction in the subject and Condonation of deficiency of marks in a subject in all the faculties prescribed by the Statute NO.18, Ordinance, 2001 shall apply to the examination under this Ordinance.
- 13) To appear for the examinations, minimum attendance in theory and practicals shall be 75% separately in each subject.
- 14) In order to be successful at the examination in Water and Soil Analysis, an examinee must obtain 35% of the total marks in each theory paper and 50% of total marks in each practical.
- 15) A successful examinee passing the Diploma courses within the minimum prescribed period obtaining not less than 75% of total marks prescribed for the examination shall be declared to have passed the examinations with Honours. The names of examinees passing the Diploma courses in the minimum prescribed period with Honours shall be published in Order of Merit.  
Examinee who are successful in Diploma course examination have obtained not less than 60% marks in aggregate shall be placed in first division, those obtained less than 60% but not less than 48% marks in the second division and all other successful examinee in the third division.
- 16) Subject to his compliance with the provisions of this Direction and of any other Ordinance in force from time to time an examinee who is unsuccessful at the examination may be readmitted to the subsequent examination on payment of a fresh fee and such other fees as may be prescribed.

17. An unsuccessful examinee on his/her readmission to the examinations shall appear only in the subjects in which he/she has failed.
18. As soon as possible after the examination, the Board of Examinations shall publish a list of successful examinees.
19. Notwithstanding anything to the contrary in this Ordinance, no person shall be admitted to an examination under this Ordinance, if he has already passed the same examinations or an equivalent examination of any other Statutory University.
20. Examinees successful at the Diploma course shall be entitled to receive the Diploma in prescribed form signed by the Vice-Chancellor.

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**Appendix-A**  
**Scheme of teaching & examination for the Diploma in Bio-informatics**

Sr. No.	Subject	Teaching Scheme				Examination Scheme				Total Marks
		Theory (Hrs.)	Pract. (Hrs.)	Total (Hrs.)	Dura- tion	Max.Marks	Min.Marks	Th.	Pract.	
						Th.	Pract.	Th.	Pract.	
<b>One Year Course</b>										
1	Molecular Biology	4	-		3 Hrs.	75	-	30	-	
2	Biological Databases & Databanks.	4	-	16	3 Hrs.	75	-	30	-	
3	Drug Design, Gene Therapy, Plant Genomics	4	-		3 Hrs.	75	-	30	-	500
4	Biocomputing and Programming	4	-		3 Hrs.	75		30	-	
5	Pr.-I : Bioinformatics	-	6			75		-	38	
6	Pr.-II : Biocomputing & Programming	-	6	18		75		-	38	
7	Project Work	-	6	-		50		-	25	
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**Appendix-B**  
**Scheme of teaching & examination for the Diploma in Soil & Water Analysis**

Sr. No.	Subject	Teaching Scheme				Examination Scheme				Total Marks
		Theory (Hrs.)	Pract. (Hrs.)	Total (Hrs.)	Dura- tion	Max.Marks	Min.Marks	Th.	Pract.	
						Th.	Pract.	Th.	Pract.	
<b>One Year Course</b>										
1	Paper-I	4	-		3 Hrs.	75	-	27	-	
2	Paper-II	4	-	16	3 Hrs.	75	-	27	-	
3	Paper-III	4	-		3 Hrs.	75	-	27	-	500
4	Paper-IV	4	-		3 Hrs.	75	-	27	-	
5	Practical-I	-	6		6 Hrs.	-	75	-	38	
6	Practical-II	-	6	18	6 Hrs.	-	75	-	38	
7	Project Work & Viva-voce	-	6	-	-	-	50	-	25	
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**Syllabus Prescribed for Diploma in Bioinformatics.****Paper-I****Molecular Biology**

- Unit-I : Biomolecules and Protein Synthesis :**
- Structure and function of Amino Acids, Proteins, Nucleic acids, Carbohydrates, Lipids and fats.
  - DNA, RNA dependent protein synthesis in Prokaryote, Eukaryote.
  - Genetic code.
- Unit-II : Gene mapping and Molecular markers :**
- Genetic mapping of chromosomes.
  - Molecular structure of chromosome and gene.
  - Molecular mapping of genes. Northern & Western Blotting.  
AFLP; RAPD; RFLP; FISH
- Unit-III : Recombinant DNA Technology :**
- Gene cloning - Principles and Techniques.
  - Vectors, Restriction Enzymes.
  - cDNA, PCR, DNA Finger Printing.
  - Probes.
- Unit-IV : Genomics and Proteomics :**
- Methods and Strategies of sequencing.  
Functional Genomics.
  - X-ray Crystallography, 2 DNMR, NMR, MS-MALDI
  - Micro-array
  - Protein evaluation, Profiles, patterns & folding.
- Unit-V : Application of Genetic Engineering :**
- r-DNA vaccines,
  - Plant Genomics,
  - Drug Development,
  - Transgenomics,
  - Chemo-Informatics,
  - Pharmacogenomics,
  - Database Development,
  - Bio-diversity informatics.

**Reference Books :**

- 1) Introduction to Practical Molecular Biology, P.D.Dabre, John Wiley & Sons Ltd., New York, 1988.
- 2) Molecular Biology LabFax, TA, Brown (Ed.), Bios Scientific Publishers Ltd., Oxford, 1991.
- 3) Molecular Biology of the Gene (4th Edition), J.D.Watson, N.H.Hopkins, J.W.Roberts, J.A.Steitz and A.M.Weiner. The Benjamin/Cummings Publ.Co., Inc., California, 1987.
- 4) Molecular Biology and Biotechnology. A comprehensive desk reference, R.A.Meyers (Ed.) VCH Publishers, Inc., New York, 1995.
- 5) Introduction to instrumental analysis, Robert Braun, McGraw Hill, International Editions.
- 6) Molecular Cell Biology, J.Darnell, H.Lodish and D.Baltimore Scientific American Book, Inc. USA.
- 7) Molecular Biology of the Cell, B.Alberts, D.Bray, J.Lewis, M.Raff, K.Roberts, and J.D.Watson, Garland Publishing Inc., New York.
- 8) Samuel Delvin, Enzymes, Sarup & Sons, N.Delhi.
- 9) Practical Biochemistry edited by Walker.
- 10) The Cell, a molecular approach : Cooper.
- 11) Molecular Cell Biology : Gerald Karp.
- 12) Microbiology - Pelczar
- 13) Biophysical Chemistry - Principles and Technique : Upadhyay, Nath.
- 14) S.F.Gilbert. Developmental Biology. Sinauer Associates Inc., Massachusetts.
- 15) Sambrook J. & D.W.Russel ; Molecular cloning - a laboratory manual Cold Spring Harbor Laboratory Press, N.Y.
- 16) Charles N. McEwen & Barbara S. Larsen : Mass Spectroscopy of Biological Materials, Marcel Dekker Inc., New York.
- 17) Johnson Lewys; Cell Biology, 1<sup>st</sup> Ed., Sarup & Sons, New Delhi.
- 18) A.L.Lehninger, D.L.Nelson and M.M.Cox : Principles of Biochemistry, CBS Publishers, New Delhi.
- 19) Harper's review of Biochemistry, Prentice Hall.
- 20) Callow, J.A., Ford-Lloyd, B.V. and Newbury, H.J. 1997. Biotechnology and Plant Genetic Resources : Conservation and Use. CAB International, Oxon, UK.
- 21) Chrispeels, M.J. and Sadava, D.E. 1994. Plants, Genes and Agriculture. Jones & Barlett Publishers, Boston, USA.
- 22) Henry, R.J. 1997. Practical Applications of Plant Molecular Biology. Chapman & Hal, London, UK.
- 23) Jolles, O. and Jornvall, H. (eds.) 2000. Proteomics in Functional Genomics, Birkhauser Verlag, Basel, Switzerland.
- 24) Raghavan, V. 1997. Molecular Biology of Flowering Plants. Cambridge University Press. New York, USA.
- 25) Shantharam, S. and Montgomery, J.F. 1999. Biotechnology, Biosafety,

and Biodiversity. Oxford & IBH Publishing Co.Pvt.Ltd., New Delhi.

- 26) Malacinski, G.M. and Freifelder, D. 1998. Essential of Molecular Biology (3rd Edition). Jones and Bartlet, Publishers, Inc. London.
- 27) Buchanan, B.B., Gruissem, W., and Jones, R.L., 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.
- 28) Lewis R., 1997. Human Genetics : Concepts and Applications (2<sup>nd</sup> Edition). WCB McGraw Hill, USA.
- 29) Benjamin Lewin, Gene VII, Oxford University Press.

**Paper-II**  
**Biological Databases & Databanks**

**Unit-I : Database Design and Management**

- DBMS, RDBMS.
- Sources of Biological Data.
- Database design and data integrity.
- Database Management, security & Architecture.

**Unit-II : Genomics Database :**

- Human Genome Project.
- Databases of model species : *Drosophila melanogaster*; *Arabidopsis thaliana*, *C.elegans*; *Saccharomyces cerevisiae*; *Danio rerio*.
- Plasmodium falsiparum Genome project.
- The Arabidopsis Genome Project.

**Unit-III : Biological Databanks :**

- NCBI, DDBJ, EMBL,
- PDB, SRS, BRENDA,
- Tr EMBL, UniProt,
- KEGG, MIAME.

**Unit-IV : Bioinformatics databases & Repositories :**

- Protein Database - GenBank
- Nucleotide & Gene database - GenBank
- Microarray Database & Analysis
- Gene Expression Profile Databases - GEO.
- Metabolic Pathway - Path DB.
- Enzyme Database - KEGG
- Ion Transport Database.

**Unit-V : Genome Analysis.**

- **Genome Anatomy** : Prokaryotic Genome - E.coli, Mycoplasma.  
Eukaryotic Genome - Human, Rat, Arabidopsis, Soyabean, Mung bean.
- **Comparative Genomics** : Proteomic analysis, Horizontal gene transfer.
- **Functional classification of gene.**
- **Gene order on Chromosome.**
- **Functional Genomics and Proteomics.**

**Reference Books : (Prescribed for Paper-II & Paper-III)**

- 1) Introduction to Protein Architecture by Mathur M.Lesk.
- 2) Mathematics of Genome Analysis : by Jerome K.Percus.
- 3) Protein Structure Prediction by Michael E.Sternberg.
- 4) Introduction to Bioinformatics by David Mount.
- 5) Developing Bioinformatics Computer Skills by Gibas, C. and P.Jambeck.
- 6) Statistical Methods in Bioinformatics. An Introduction By : Warren J.Ewens and Gregory R.Grant, Published by : Springer Verlag; 1st edition (April 20, 2001).
- 7) Bioinformatics : Sequence and Genome Analysis by David W.Mount, Published by : Cold Spring Harbor Laboratory; 1st Edition (April 1, 2001).
- 8) Beginning PERL for Bioinformatics by James Tisdall, Published by Orally Publication, New Delhi.
- 9) DNA Microarrays and Gene Expression : From Experiments to Data Analysis and Modelling by Pierre Baldi et al, Published by MIT Press 1st Edition (August 21, 2000)
- 10) Bioinformatics (Adaptive Computation and Machine Learning) by Pierre Baldi, et al Published by MIT Press (February 13, 1998).
- 11) Computation Molecular Biology : An Algorithmic Approach (Computation Molecular Biology) by Pavel A.Pevzner, Published MIT Press (August 21, 2000)
- 12) Introduction to Computational Biology : MAPS, Sequences and Genome : By Michael S.Waterman, Published by CRC Press; (June 1, 1995)
- 13) Genomic PERL : From Bioinformatic basic to working code by : Rex A.Dwyer, Published by : Cambridge University Press; Book and CD-ROM edition (July 15, 2002)
- 14) Statistical Methods in Bioinformatics by : W.J.Ewens, GR Grant, Published by : Springer Verlag, 1st Edition (April 20, 2001) ISBN : 0387952292.

- 15) Statistical Genomics and Bioinformatics by : Ben Hui Liu, Published by : Cambridge University Press, (October, 2003) ISBN-0521819822.
- 16) Data Analysis and Classification for Bioinformatics by A.Jagota, Published by Bioinformatics by the Bay Press; (August 1, 2000) ISBN-0970029705.
- 17) Hidden Markov Models for Bioinformatics by T.Koski, T.Koskinen, Published by Kluwer Academic Publishers; 1st Edition (December 15, 2001) ISBN : 1402001355.
- 18) Molecular Modelling : Principles and Applications, By : Andrew R.Leach, Published by : Prentice Hall; 2nd Edition, (March 30, 2001) ISBN : 0582382106.
- 19) Introduction to Computational Chemistry By Frank Jensen Published by John Wiley and Sons; (October 1999) ISBN-0471984256.
- 20) Essential of Computational Chemistry : Theories and Models by Christopher J.Cramer, Published by John Wiley and Sons (May, 2002) ISBN-0471485527.
- 21) Computational Chemistry by Guy H.Grant et al Published by Oxford University Press, (May, 1995) ISBN : 019855740x.
- 22) Introduction to Protein Structure by Carl-Ivar Branden, John Tooze, Published by Garland Pub; (September 1991) ASIN : 0815303440.
- 23) Molecular Modelling and Simulation by Tamar Schlick, Published by Springer Verlag (August 19, 2002) ISBN : 038795404X.
- 24) Structural Bioinformatics by Phillips E.Bourne, Helge Weissig Published by : Wiley-Liss (February, 2003), ISBN-0471201995.
- 25) Computational Analysis of Biochemical System : A Practical Guide for Biochemists and Molecular Biologists, by Eberhard O.Voit, Published by Cambridge University Book and CD-ROM edited (November, 2000) ISBN-0521785790.
- 26) Classification and Regression Trees by Leo Breiman, Published by Kluwer Academic Publishers; (January 1, 1984) ISBN-0412048418.
- 27) Introduction to Protein Architecture by Arthur M.Lesk, Published by Oxford University Press, (2001); ISBN-0198504748.
- 28) Computational Modeling of Genetics and Biochemical Networks (Computational Molecular Biology) by James M.Bower, Hamid Bolouri; Published by MIT Press; 1st Edition, (January 22, 2001) ISBN : 0262024810.
- 29) Protein Structure Prediction : Methods and Protocols by David M.Webster, Published by : Human Press; 1st Edition (August 15, 2000) ISBN : 0896036375.
- 30) Bioinformatics : A Practical Guide to the Analysis of Genes and Proteins by Andreas Baxevanis, B.F.Francis Ouellette, and B.F. Cuellette, Published by John Wiley and Sons, 1st Edition, July 14, 1998. ASIN-0471191965.
- 31) Introduction to Bioinformatics by Attwood, T and D.J.Parry-Smith ed., Pearson Education UK, 1999.

**Paper-III****Drug Design, Gene Therapy & Plant Genomics**

- Unit-I : Drug Discovery & Design.**
- Introduction, Methods of Drug Design.
  - Rational based drug design.
  - Ligand based drug design.
  - Cell based drug design.
  - Carbohydrate based drug design.
  - Lead optimization
  - Computer aided drug design.
  - Molecular modeling & docking.
- Unit-II : Chemi-informatics :**
- Introduction
  - Mechanism and Dynamics of Biomolecular drugs.
  - Simulation of free energy changes.
  - Force field, surface activity; electric potential.
  - Intermolecular forces.  
Vander waals; Bonding activity, H-H, C-H,  
Hydrophobicity; Hydrophilicity.
  - Hansch analysis, CoMFA.
- Unit-III : Gene Manipulation and Therapy :**
- Introduction
  - Gene Therapy - Principle and Technique.
  - Primer Design Tools, e PCR.
  - Oligonucleotides & Probes.
  - Nanoballs, nanorobotics.
  - Pharmacogenomics
  - Nutricogenomics
  - Antigeneicity, MHC-I, MHC-II, HLA.
- Unit-IV : Plant Genomics :**
- Introduction
  - Plant Genome Databases.
  - Study of Plant Species.  
*Arabidopsis thaliana*, *Gossypium hirsutum*, *Oriza sativa*, *Soabean*, *Mungbean*.
  - Transgenics  
e.g. Plants Transgenics in cotton, tomato, animals-  
mouse.
  - Emerging Areas of Plant Genomics.



**Unit-V : Emerging areas of Bioinformatics :**

- Introduction
- Drug Target identification.
- Genechip or DNA chips.
- Phylogenetics studies.
- Transgenomics
- Medicinal informatics
- Forest informatics.

**Paper-IV****Bio-computing and Programming****Unit-I : Object Oriented Programming (OOPS) - C++**

- Introduction to OOPS.
- Data types : Array objects.
- Class Structure
- Function methods.
- Pointer, Polymorphism, inheritance.

**Unit-II : Relational Database Management System (RDBMS) Oracle 9 i.**

- Database definitions, DBMS, RDBMS, ORDBMS.
- SQL
- PL/SQL
- Oracle - architecture.

**Unit-III : Perl for Bioinformatics.**

- What is Perl? Perl for Bioinformatics.
- Datatypes, variables, control statements.
- Arrays, object, classes.
- Function.

**Unit-IV : Operating System Linux :**

- Introduction to Linux Red Hat.
- Installation of Linux Red Hat.
- Commands and Shell Programming.

**Unit-V : Dataware Housing and Data Mining :**

- Introduction of dataware housing.
- Data mining.
- Graph & Charts.

**Reference Books :**

- 1) V.Carl Hamachev : Computer Organisation 4/e (Mc Graw Hill)
- 2) A.S.Tenanbaum : Structured Computer Organisation (PHI)
- 3) Bjarne stroutstrup : The C++ Programming Language (Addison-Wesley)
- 4) Ranade & Zamir : C++ Primer (McGraw-Hill)
- 5) Robert Lafore : OOP with C++ (Galgotia)
- 6) E.S.Loomis : Data Management & File Structures (PHI)
- 7) Lipschutz : Data Processing (Schaum Out Line)
- 8) Lipschutz : Data Structures (Schaum Out Line)
- 9) J.F.Gerald : System Analysis & Design (McGraw-Hill)
- 10) D.M.Damdhere : System software & Operating Systems (TMH)
- 11) Sibershatz : Operating Systems Concepts (Addison Wesley)
- 12) Oracle Press Introduction to Oracle (TMH)
- 13) Oracle Unleashed (Sams)
- 14) J.Fitzgerald & A.Denis : Business data Communication & networking (5/e) (John Wiley & Sons)
- 15) Schweber data Communication (McGrawHill)
- 16) Miller digital & Data Communication (Jaico)
- 17) R.Ramkrishnan : Database Management Systems (McGraw Hill)
- 18) C.J.Date : Introduction to Database Management Systems (AWL)
- 19) Korth & Silbeshatz : Database System Concepts (McGraw Hill)
- 20) M.S.Bach : Design of Unix OS (PHI)
- 21) A.S.Tenenbaum : Operation Systems (PHI)
- 22) D.E.Comes : Operating System Design (Prentice Hall)
- 23) Crowley Operating System (McGraw Hill)

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**Bio-informatics****Practical-I****(Based On Paper-II & III)**

- 1) Database Search :  
NCBI, DDBJ, EMBL, BRENDA, KEGG, Uni Prot, MIAME.
- 2) Primary Sequence Analysis of Proteins.  
Prot PARAM.
- 3) Secondary Structure Prediction.  
GOR, JPRED, SOPMA, CHOUFASMAN.
- 4) Tertiary Structure Analysis.
- 5) Pair wise Sequence Alignment.  
FASTA, BLAST.
- 6) Multiple Sequence Alignment.  
CLUSTALW.
- 7) Phylogenetic Analysis.  
PHYLIP, PAUP.

- 8) Method of Gene Prediction- GenScan, GeneMark.
- 9) Motif Prediction.
- 10) Structural Visualization and Molecular Modelling.  
e.g. RasMol, MolMol, Chime.

**Distribution of Marks for Practical-I  
(Based On Paper-II & III)**

Hours : 8 Hrs Total Marks : 75

Q.1 Major Exercise	---	20
Q.2 Major Exercise	---	20
Q.3 Minor Exercise	---	10
Q.4 Minor Exercise	---	10
Q.5 Class Record	---	10
Q.6 Viva-voce	---	05

(Note : Q.1 & Q.3 will be based on Paper-II and Q.2 & Q.4 will be based on Paper-III)

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**Biocomputing and Programming.  
Practical-II  
(Based On Paper-IV)**

- Sec-A)**
- 1) Computer basic and Fundamentals.
  - 2) M.S. Office, MS-Excel, Power Point.
  - 3) Windows 9X
  - 4) XP, NT
  - 5) Linux RedHat
- Sec-B)**
- 6) C++ fundamentals, Pointer Basics, Object, Classes, Polymorphism, inheritance, Streams and Exception Handling.
  - 7) RDBMS Fundamentals : Various functions in SQL, Table, Table related commands and Database connectivity.
  - 8) PL/SQL procedure, function, triggers, cursors, Package & Body, Error handling.
  - 9) Perl for Bio-informatics, Scripting & Programming of DNA to RNA conversions. ATGC count. ORF prediction.
  - 10) HTML, Data Warehousing and Data mining.

**Distribution of Marks for Practical-II  
(Based On Paper-IV)**

Hours : 8 Hrs	---	Total Marks : 75
Q.1 Major Exercise	---	20
Q.2 Major Exercise	---	20
Q.3 Minor Exercise	---	10
Q.4 Minor Exercise	---	10
Q.5 Class Record	---	10
Q.6 Viva-voce	---	05

(Note : Q.1 & Q.3 will be based on Sec-A and Q.2 & Q.4 will be based on Sec-B)

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**Practical-III**

**Project Work.**

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**SYLLABUS PRESCRIBED FOR DIPLOMA IN**

**SOIL & WATER ANALYSIS.**

**PAPER-I**

**BASIC PRINCIPALS IN ANALYSIS**

- Unit-I** :- General Principals of Chemistry Weight, Atomic Weight, Molecular Weight, Equivalent Weight, Standard Solution, Strength of Solution, Normality, Molarity, Molal Solution, Formal Solution, percentage composition by weight and by volume, Strength or Percentage strength, ppm, Milli equivalency per litre.
- Unit-II** :- Titrometry :-pH, Acids, bases, buffers, preparation of buffer solutions, neutralization reaction, titrant, titrate, equivalent point, end point, indicators used in fixation, volumetric and gravimetric analysis.
- Unit-III** :- Basic Statistical Analysis:  
Basic knowledge of statistical, mean, mode, median, tabulation of data, histogram, ogive, pie-chart, bar chart, Data presentation, probability, Degree of freedom, deviation, variance, standard deviation, standard error, confidence limit, significance of test, regression, correlation, non linear relationship.

- Unit-IV :-** Laws and Acts of Environmental Pollution.
- (1) Ministry of Environment & Forest, GOI, Notification 20th July, 1998, 6th March, 2000, 2nd June, 2000, 25th Sept., 2000.
  - (2) Environment Department, Govt. of Maharashtra, Notification, 8th March, 1999.
  - (3) MPCB, Public Notices.
  - (4) Hazardous Waste (M & H) Rules, 1989.
  - (5) Bio-medical Waste (M & H) Rules, 2000.
  - (6) Municipal Solid Waste (M & H) Rules, 2000.

- Unit-V :-** Computer application in data analysis.  
Fundamentals of Computers, DOS, Window, Various Softwares for data analysis, Computer based Statistical analysis, STATA, SAS, SPSS.

### PAPER-II INSTRUMENTATION IN ANALYSIS.

- Unit-I :-** General Principles.  
Instrumental methods of analysis for organic and inorganic content of Soil and Water. Theory and principles of instrument used in laboratory Balance, pH meter, D.O. meter, Water/Soil analysis kit, Water distillation plant, Deionizer, Microscope, Autoclave, Incubator, oven, laminar flow bench, Record keeping, repairing, Repair of instruments, Solvent extraction.
- Unit-II :-** Spectrophotometry :-  
Beers- Lambert law, General Principle of colorimeter, Spectrometry, -Principle and uses, -visible and ultra violet spectrophotometry, infrared spectrophotometry, Absorption Spectrophotometry, fluorimetry, flame photometry, outline of NMR, and ESR, turbidometry.
- Unit-III :-** Chromatography :  
General principle, paper, column, thin layer, Gas and ion exchange and affinity, chromatography, Gel filtration.
- Unit-IV :-** Electrophoresis--  
General principle, paper and Gel electrophoresis, moving boundary electrophoresis.

- Unit-V :-** Soil and Water pollution:  
Source of pollution, detection of pollutant, health hazard due to pollutant, quality of water in Indian Rivers, Remediation of pollutants.

### PAPER III WATER ANALYSIS

- Unit-I :-** General analysis  
Practical and essential principle of water and soil sampling. Basic concept in quantitative analysis of physical, chemical and biological parameters, sampling, sample preparation and preservation technique and quality assurance, and quality control. Development of optimum monitoring strategy, scheduling and sampling frequency, Water classification diagram.
- Unit-II :-** Water analysis -  
Introduction, characteristics of water, Physico-chemical and microbiological standards of potable water, effluent standard. Collection of sample, types of examination, Physical examination, Expression of results, test report of water sample.
- Unit-III :-** Physico-chemical analysis of water.  
Grab sample, composite sample, quantity of sample, sampling in large rivers and streams, sampling sewage, industrial effluent, preservation of sample, labelling of sample, chemical examination of water, Theory and Principle, odour, colour, taste, turbidity, pH, TDS, conductivity, chloride and salinity, Acidity, Alkalinity, total hardness, Ca & Mg, suspended solids, fluoride, sulphate, Iron, manganese nitrite, nitrate, residual chlorine, D.O., Na & K, Coagulant dose, available chlorine in bleaching powder.
- Unit-IV :-** Biological analysis of water.  
Methods of sampling, microbiological examination of water, presumptive test, confirmed test, completed test, MPN, count test for fecal and nonfecal coliform, Rapid test for detection of fecal contamination in drinking water, Rapid H<sub>2</sub>S test, test for fecal streptococci, test for clostridium welchii, B.O.D. CO.D. General information to be submitted with sample, expression of results.

- Unit-V :-** Standard of quality of water.  
Physical characteristics, chemical standard, Bacteriological Standard, Visrological Standard, tolerance limit, B.S.I, & ISI standard, International standard for drinking water, limits of pesticides in water.

**PAPER-IV  
SOIL ANALYSIS**

- Unit-I :-** Sample collection, processing, and preservation, Chemical methods for chemical characterization elemental analysis, AA, HGA, NAA, XRF, ICP, soil chemical p r o p e r t i e s including pH, cation-exchange capacity, soluble salts salinity, organic C, organic matter, Texture classification of soil.
- Unit-II :-** Chemical methods used to evaluate nutrient bioavailability, plant nutrition and soil fertility, and environmental impact: plant tissue testing, nitrogen, phosphorus, macronutrient and micronutrients in soil/plant/water, universal extraction methods including in situ resin extraction.
- Unit-III :-** Environmental contaminant assessment concepts and chemical methods. Measuring pesticides/toxic organics, and heavy metal contamination and bioavailability in environmental samples. Chemical methods for evaluating water quality and soil quality. Laboratory QA/QC theory and concepts (accuracy, precision, detection limits, practical quantitation limits, control charts, acceptable data).
- Unit-IV :-** Soil cycles.  
Nitrogen cycle :- Sources, nitrogen fixation, transformation, in flooded and uplands soils, Immobilization, mineralization, nitrogen in relation to atmospheric pollution.  
Phosphorus cycle :- Sources of inorganic and organic fraction of soils Fixation and transformation, availability of phosphate potential. Intensity and quality factors and buffering capacity.
- Unit-V :-** Environmental Pollutants.  
Sources of pollution of soil, soil pollutant, health research due to soil pollutant, residual insecticides pollution due to organic/chemical fertilizers, chemical pollutant, such as Cadmium, Chromium, Nickel, lead, Mercury, Organic and inorganic pollutant.

**Books**

- 1) Brady, N.C. and R.R. Weil, 2002. The nature and properties of soils, 13th edition, Pearson Education Inc. (General reference on soil science, available on reserve in MCML Library)
- 2) Carter, M.R. 1993. Soil sampling and methods of analysis. Canadian Society of Soil Science, Lewis Publ., Boca Raton, FL.
- 3) Dane, J.H. and G.C. Topp. 2002. Methods of soil analysis. Part 4 - Physical methods. Soil Science Society of America, Book Series No.5. SSSA, Madison. WI.
- 4) MeKeague, J.A. 1978. Manual of soil sampling and methods of analysis. 2nd edition. Canadian Society of Soil Science.
- 5) Page, A.L. 1982. Methods of soil analysis: chemical and microbiological properties. Part 2, 2nd edition. ASA-SSSA, Madison, WI.
- 6) Sparks, D.L. 1996. Methods of soil analysis. Part-3- Chemical methods. Soil Science Society of America. Book Series NO.5. ASA-SSSA, Madison, WI.
- 7) Soil Web. 2004. On- line teaching tool for the SOIL.200 course developed by Dr. Maja Krzic. 66 <http://www.agsci.ubc.ca/soil200/> (Quick overview of basic concepts of soil science)
- 8) Westerman, R.L. 1990. Soil testing and plant analysis. 3rd edition. ASA-SSSA, Madison, WI.
- 9) K.V.S.G. Murlikrishna : Chemical analysis of water and soil. A Laboratory Manual (Environmental Protection Society, P.B.9, Nagarjuna Road, Kokinada - 533 003
- 10) A manual on water and waste water analysis, NEERI, Nagpur, 1988.
- 11) IS : 10500-1991, Drinking Water Standards, BIS, New Delhi, 1991.
- 12) Manual on Analytical Instrumentation of Environmental Engineering, NEERI, Nagpur, 1989.
- 13) Standard methods for the examination of water and waste water, APHA, 2005. (21st Ed.)

**Practical I : Water analysis**

**(75 Mark)**

- (1) Procedure for collection of water sample.
- (2) Analysis of Physical parameters of water.
  - i) Colour, Odour, & taste. turbidity, pH. Conductivity, T.D.S.
- (3) Analysis of Chemical parameter of Water.
  - i) Chloride & Salinity, ii) Acidity, iii) Alkalinity, Carbonate, & Bicarbonates. iv) Total hardness - Calcium, Magnesium, v) Settleable solids, (vi) Solids - total, suspended & dissolved. (vii) Fluoride, (viii) Sulphate, (ix) Iron & Manganese. (x) Nitrite, (xi) Nitrate, (xii) D.O. (xiii) Residual chlorine. (xiv) Sodium & potassium. (xv) Jar test for optimum coagulant dose.
- (4) Microbiological analysis of Water - i) Cram Staining ii) preparation of Bacteriological media, (iii) Multiple tube dilution test, (iv) Imvic test,

(v) MPN test (vi) Rapid H<sub>2</sub>S test (vii) Identification & differentiation of fecal and non-fecal coliforms. (viii) Isolation & Identification of Streptococci fecalis & Clostridium welchii. (ix) B.O.D. (x) C.O.D.

(5) Test report of water analysis.

**Practical II : Soil analysis**

**(75 marks)**

- (1) Preparations of Standard Solutions.
- (2) Preparation of 1000 ppm solutions.
- (3) Uses, maintenance & Servicing of laboratory instruments.
  - (a) pH meter
  - (b) EC meter
  - (c) Flame photometer
  - (d) Colorimeter
  - (e) Spectrometer
  - (f) Double distillation unit
  - (g) A.A.S. Apparatus
  - (h) Microscope.
  - (i) Soil/Water analysis kit.
- (4) Preparation & analysis of Soil Sample.
  - i) Determination of pH, Standardization of pH meter.
  - ii) Determination of E.C., Organic Carbon (Spectrophotometrically)  
Available Nitrogen, Available P<sub>2</sub>O<sub>5</sub>, Available K<sub>2</sub>O
- (5) Special soil analysis
  - i) Organic carbon ii) free lime, by rapid titration, (iii) Calcium/Magnesium by versenate method.
  - (iv) Exchangeable Na, (v) Moisture content (vi) Mechanical analysis- (International pipette method)
  - (vii) Maximum water holding capacity
  - (viii) CEC. with/without Sodium.
- (6) Micro Nutrient analysis
  - i) Preparation of various -- (DTPA)
  - ii) AAS Machine
- (7) E.C. Recording according to temp.
- (8) Test report of Soil sample
- (9) Analysis of lime
- (10) Available Chlorine in bleaching powder.

**Practical - III :**

**(50 marks)**

Project work on theory / practical work.

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