

**Deccan Education Society's  
Fergusson College (Autonomous), Pune**

**Department of Microbiology  
M. Sc. – I Microbiology**

<b>Semester</b>	<b>Course Code</b>	<b>Title of the Course</b>	<b>Core / Elective</b>	<b>No. of Credits</b>
II	MIC4201	Virology	Core	4
	MIC4202	Biostatistics	Core	4
	MIC4203	Microbial Metabolism	Core	4
	MIC4204	Advanced Environmental Microbiology	Core	4
	MIC4205	Practical course I: Virology and Environmental Microbiology	Core	4
	MIC4206	Practical Course II: Biostatistics & Microbial Metabolism	Core	4
	MIC4207	Scientific Communication – II	Core	1
<b>TOTAL</b>				<b>25</b>

**Extra Credits**

<b>Semester</b>	<b>Course Code</b>	<b>Title of the Course</b>	<b>No. of Credits</b>
II	XHR0004	Human Rights -II	1
	XCS0005	Introduction to Cyber Security / Information security -II	1
	XSD0006	Skill Development -II	1
<b>TOTAL</b>			<b>03</b>

Deccan Education Society's Fergusson College

Department of Microbiology

M.Sc. –I MIC4201 VIROLOGY

Unit No.	Topics
1	<p><b>General Virology:</b></p> <p>a) <b>Unique features of viral/ acellular life forms:</b> wrt genome and its organization, size, shape, growth and multiplication</p> <p>b) <b>Structure of viruses</b></p> <ul style="list-style-type: none"><li>• Enveloped and Non enveloped viruses</li><li>• Capsid symmetries – Icosohedral, Polyhedral and Helical</li><li>• Structural components of virus – Protein - Envelope proteins, Matrix proteins and Lipoproteins ,Genome – dsDNA, ssDNA, dsRNA, ssRNA (positive sense, negative sense and ambisense), linear, circular, segmented</li><li>• Virus related structures – Viroids and Prions</li></ul> <p>c) <b>Classification &amp; nomenclature of viruses</b></p> <ul style="list-style-type: none"><li>• ICTV nomenclature</li><li>• Baltimore classification</li></ul> <p><b>References:</b></p> <ol style="list-style-type: none"><li>1. Flint S. J., V. R. Racaniello, L. W. Enquist, V. R.Rancaniello, A. M. Skalka, (2003), Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses, American Society Microbiology.</li><li>2. Edward K. Wagner, Martinez J. Hewlett, (2004), Basic Virology, Blackwell Publishing</li><li>3. Baltimore D. (1971), Expression of Animal Virus Genomes, Microbiology and molecular Biology Reviews, 35(3), 235 – 241.</li><li>4. Prusiner S. B. (1995) The Prion Diseases, Scientific American (1):48-57.</li><li>5. Reisner D. &amp; Gross H.J. (1985).Viroids Ann. Rev. Biochem.54:531-64</li><li>6. Fenner F (1976) The Classification and Nomenclature of Viruses Summary of Results of Meetings of the International Committee on Taxonomy of Viruses in Madrid, September 1975, Journal of General Virology, 31, 463-470.</li><li>7. <a href="http://ictvonline.org/codeOfVirusClassification_2012.asp">http://ictvonline.org/codeOfVirusClassification_2012.asp</a></li></ol>
2	<p><b>Replication of viruses</b></p> <ul style="list-style-type: none"><li>• Mechanism of virus adsorption and entry into host cell</li><li>• Genome replication</li></ul>

- Post transcriptional processing
- Synthesis of viral proteins: polyprotein and proteolytic cleavage leading to generation of viral
- Protein nucleic acid interactions and genome packaging
- Assembly, exit and maturation of progeny virions

**References:**

1. Flint S. J., V. R. Racaniello, L. W. Enquist, V. R. Rancaniello, A. M. Skalka, (2003), Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses, American Society Microbiology.

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**a) Cultivation of viruses:**

- In ovo: using embryonated chicken eggs
- In vivo: using experimental animals
- Ex vivo / In vitro: using various cell cultures - primary and secondary cell lines, suspension cell cultures and monolayer cell culture
- In plants and plant cell cultures

**b) Diagnostic and detection methods:**

- Sampling techniques and Processing of samples – Enrichment and concentration
- Direct methods of detection – Light microscopy (inclusion bodies), Electron microscopy and Fluorescence microscopy
- Immunodiagnosis, Hemagglutination and Hemagglutination-inhibition tests, Complement fixation, Neutralization, Western blot, Radioactive Immuno Precipitation Assay (RIPA), Flow Cytometry and Immunohistochemistry
- Nucleic acid based diagnosis: Nucleic acid hybridization, Polymerase Chain Reaction (PCR), Microarray and Nucleotide sequencing, LINE probe assay
- Infectivity assay for animal and bacterial viruses - Plaque method, Pock counting, End point methods, LD50, ID50, EID50, TCID50
- Infectivity assays of plant viruses

**References:**

1. Flint S. J., V. R. Racaniello, L. W. Enquist, V. R. Rancaniello, A. M. Skalka, (2003), Principles of Virology: Molecular Biology, Pathogenesis, and Control of Animal Viruses, American Society Microbiology.
2. Mahy B. W. J. and Kangro H. O., (1996), Virology Methods Manual, Academic Press.  
Stephenson J. R. and Warnes A., (1998), Diagnostic Virology Protocols: Methods in Molecular Medicine, Humana Press.

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**a) Life cycle of representative viruses**

- Human virus – HIV, Polio
- Bovine virus – FMD virus
- Avian virus – Newcastle disease virus
- Baculovirus
- Tobacco mosaic virus
- Cauliflower mosaic virus
- T (odd and even phages)
- Lambda phage
- M13 phage
- Phi X 174 phage
- P1 phage

**b) Emerging viruses**

**References:**

1. Murphy F. A., Gibbs E.P.J., Horzinek M.C. and Studdert M. J. (1999) Veterinary Virology, 3<sup>rd</sup> Ed. Academic Press.
2. Kayser F. H., Bienz K. A., Eckert J. and Zinkernage
3. R. M. (2004), Medical Microbiology, Thieme.
4. Burton E .Tropp (2008). Molecular Biology Genes to proteins (3<sup>rd</sup> edition). Jones and Bartlett Publishers.
5. Peter.J. Russell (2011). iGenetics- molecular approach. Pearson Education.
6. Agrios G (2005) Plant Pathology, 5<sup>th</sup> edition. Elsevier Academic Press.
7. Hull R (2002) Matthew's Plant Virology, 4<sup>th</sup> edition. Academic Press.
8. Gibbs Adrian & Bryan Harrison ( ) Plant Virology -The Principles. Edward Arnold Press.
9. Strauss J. H. and Strauss E. G. (2002), Viruses and Human Disease, Academic Press
10. Knipe David M., Peter M. Howley, Diane E. Griffin, Robert A. Lamb, Malcolm A. Martin, Bernard Roizman, Stephen E. Straus, (2007), Field's Virology, 5th Ed. Lippincott Williams & Wilkins

## M.Sc. - I MIC4202 BIOSTATISTICS

Unit No.	Topics
1	<p><b>Introductory Biostatistics, Data Representation and Interpretation</b></p> <ul style="list-style-type: none"> <li>• Importance of statistics in Biology, Samples and Population,</li> <li>• Types of data, Random sampling methods and sampling errors, Scales and Variables, Accuracy and precision, Collection and organization of data, tabulation, diagrammatic representation (Simple bar diagram, percentage bar diagram, multiple bar diagram, sub-divided bar diagram and pie diagram, pictogram). Graphical representation (Histogram, frequency polygon and ogive curves survival curves),</li> <li>• Kaplan Meier survival curve</li> <li>• Analyzing data obtained from research papers</li> </ul> <p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Goon, Gupta and Dasgupta Fundamentals of Statistics, World Press Kolkata</li> <li>2. Gupta S. P. Statistical methods, Sultan Chand &amp; Sons Publisher, New Delhi</li> <li>3. Irfan Ali Khan and Atiya Khanum, Fundamentals of Biostatistics. 3<sup>rd</sup>Ed. Ukaaz, Publications, Hyderabad</li> </ol>
2	<p><b>Descriptive Statistics and Probability</b></p> <ul style="list-style-type: none"> <li>• Measures of central tendency—Mean(arithmetic, geometric, harmonic) median , mode, quartiles, percentiles</li> <li>• Measures of dispersion—Mean deviation Standard deviation and Variance;</li> <li>• Measures of skewness;</li> <li>• Regression and correlation</li> <li>• Concept of Probability – classical definition, discrete and continuous random variable, notion of density/ mass function</li> <li>• Probability distribution – Normal (x-scale and z-scale), Binomial and Poisson distributions.</li> </ul> <p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Gupta S.P. Statistical methods, Sultanchand &amp; Sons Publisher, New Delhi</li> <li>2. Irfan Ali Khan and Atiya Khanum, Fundamentals of Biostatistics. 3<sup>rd</sup>Ed. Ukaaz, Publications, Hyderabad</li> <li>3. Bernard Rosner Fundamentals of Biostatistics, 5<sup>th</sup>Ed. Duxbury Thomson</li> </ol>
3	<p><b>Testing of Hypothesis - I</b></p> <ul style="list-style-type: none"> <li>• The concepts of null hypothesis, alternative hypothesis, significance level, type I and type II errors, p-value, one tailed and two tailed tests</li> <li>• Distribution of sample means, standard error and confidence interval, Degrees of freedom</li> <li>• Equality of two population means - t-tests and z - test, z proportions, paired t test</li> <li>• Non Parametric Tests – Median Test, Mann Whitney U Test, Wilcoxon Signed Rank Test</li> <li>• <math>\chi^2</math>(chi square)test –test for goodness of fit, independence</li> </ul>

	<p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Irfan Ali Khan and Atiya Khanum, Fundamentals of Biostatistics. 3<sup>rd</sup>Ed. Ukaaz, Publications, Hyderabad</li> <li>2. Gupta S.P. Statistical methods, Sultan Chand &amp; Sons Publisher, New Delhi</li> <li>3. Norman T.J. Bailey Statistical methods in biology, 3<sup>rd</sup>Ed. Cambridge University Press</li> </ol>
4	<p><b>Testing of Hypothesis - II</b></p> <ul style="list-style-type: none"> <li>• Concept of Design of Experiments</li> <li>• Principles of Design – Replication, Randomization, Local Control (Blocking)</li> <li>• Concept of ANOVA for comparison of three or more samples (one way and two way)</li> <li>• Factorial Designs, analyzing <math>2^2</math> and <math>2^3</math> designs using Yates table</li> <li>• Plackett Burman Design</li> </ul> <p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Goon, Gupta and Dasgupta Fundamentals of Statistics, World Press Kolkata</li> <li>2. Gupta S.P. Statistical methods, Sultan Chand &amp; Sons Publisher, New Delhi</li> <li>3. Irfan Ali Khan and Atiya Khanum, Fundamentals of Biostatistics. 3<sup>rd</sup>Ed. Ukaaz, Publications, Hyderabad</li> </ol>

## M. Sc. - I MIC4203 MICROBIAL METABOLISM

Unit No.	Topics
1	<p><b>Nitrogen metabolism</b></p> <ul style="list-style-type: none"><li>• Biochemistry of biological nitrogen fixation</li><li>• Properties of nitrogenase and its regulation</li><li>• Ammonia assimilation with respect to glutamine synthetase, glutamate dehydrogenase, glutamate synthetase, their properties and regulation</li><li>• Biosynthesis of five families of amino acids and histidine</li><li>• Biosynthesis of purine and pyrimidine bases</li></ul> <p><b>References</b></p> <ol style="list-style-type: none"><li>1. White David (2000) <i>Physiology and Biochemistry of Prokaryotes</i>. 2nd Ed. Oxford University Press, New York.</li><li>2. Mandelstam Joel and McQuillen Kenneth (1976) <i>Biochemistry of Bacterial Growth</i>, Blackwell Scientific Publication London.</li><li>3. Nelson D. L. and Cox M. M. (2005) <i>Lehninger's Principles of Biochemistry</i>, Fourth edition, W. H. Freeman &amp; Co. New York.</li><li>4. Moat Albert G. and Foster John W. (1988) <i>Microbial Physiology</i> 2nd Ed. John Wiley and Sons New York.</li></ol>
2	<p><b>Anaerobic respiration</b></p> <ul style="list-style-type: none"><li>• Concept of anaerobic respiration<ol style="list-style-type: none"><li>a) Components of electron transfer system</li><li>b) Energy generation of bacteria where nitrate, sulfate and carbonate acts as terminal electron.</li><li>c) Assimilatory and dissimilatory mechanisms.</li></ol></li><li>• Ammonia oxidizing bacteria</li><li>• Methanogens : Mechanism and energy conservation</li></ul> <p><b>References:</b></p> <ol style="list-style-type: none"><li>1. Nelson D. L. and Cox M. M. (2005) <i>Lehninger's Principles of Biochemistry</i>, Fourth edition, W. H. Freeman &amp; Co. New York.</li><li>2. Segel Irvin H. (1997) <i>Biochemical Calculations</i> 2nd Ed., John Wiley and Sons, New York</li><li>3. Garrett, R. H. and Grisham, C. M. (2004) <i>Biochemistry</i>. 3<sup>rd</sup> 1Ed. Brooks/Cole, Publishing Company, California.</li></ol>

3	<p><b>Aerobic respiration</b></p> <ul style="list-style-type: none"> <li>• Structure of mitochondria,</li> <li>• Components and organization of mitochondrial electron transport chain,</li> <li>• Structure and function of F1F0 ATPase</li> <li>• Generation and maintenance of proton motive force</li> <li>• Oxidative phosphorylation</li> <li>• Inhibitors and un-couplers of electron transport chain and oxidative phosphorylation</li> <li>• Chemolithotrophs: Energy conservation</li> </ul> <p><b>References</b></p> <ol style="list-style-type: none"> <li>1. Moat Albert G. and Foster John W. (1988) <i>Microbial Physiology</i> 2nd Ed. John Wiley and Sons New York.</li> <li>2. Nelson D. L. and Cox M. M. (2005) <i>Lehninger's Principles of Biochemistry</i>, Fourth edition, W. H. Freeman &amp; Co. New York.</li> <li>3. Michael T. Madigan, John M. Martinko, David A. Stahl, David P. Clark (2012) <i>Brock Biology of Microorganisms</i>, Thirteenth edition, Benjamin Cummings, San Francisco.</li> </ol>
4	<p><b>Photosynthesis</b></p> <ul style="list-style-type: none"> <li>• Energy considerations in photosynthesis, light and dark reactions</li> <li>• Plant systems: electron carriers in photosystems, I and II, cyclic and noncyclic flow of electrons, Z scheme, Hills reaction and photolysis of water</li> <li>• Bacterial photosynthesis: scope, electron carriers, photosynthetic reaction centres, cyclic flow of electrons, bacterial photophosphorylation in various groups of phototrophic bacteria, electron donors other than water in anoxygenic photosynthetic bacteria</li> </ul> <p><b>References</b></p> <ol style="list-style-type: none"> <li>1. White David (2000) <i>Physiology and Biochemistry of Prokaryotes</i>. 2nd Ed. Oxford University Press, New York.</li> <li>2. Mandelstam Joel and McQuillen Kenneth (1976) <i>Biochemistry of Bacterial Growth</i>, Blackwell Scientific Publication London.</li> <li>3. Nelson D. L. and Cox M. M. (2005) <i>Lehninger's Principles of Biochemistry</i>, Fourth edition, W. H. Freeman &amp; Co. New York.</li> <li>4. Moat Albert G. and Foster John W. (1988) <i>Microbial Physiology</i> 2nd Ed. John Wiley and Sons New York.</li> </ol>



## M. Sc. - I MIC4204 ADVANCED ENVIRONMENTAL MICROBIOLOGY

Unit No.	Topics
1	<p><b>Environment impact assessment and tools</b></p> <ul style="list-style-type: none"> <li>• Methods for investigating microbial community changes- Microscopy, SIP, NanoSIMS, FISH, probes</li> <li>• Environment Impact Assessment:               <ol style="list-style-type: none"> <li>a) Introduction: What is EIA and its need</li> <li>b) Types of Impacts and their attributes. Determining the most significant impacts</li> <li>c) Phase I studies: Initial inquiries</li> <li>d) Phase II studies: Full EIA study</li> <li>e) Arriving at the findings (identify, predict and judge)</li> </ol> </li> <li>• Genetically Modified Organisms</li> </ul> <p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Sebastian Behrens et al., (2008). Linking Microbial Phylogeny to Metabolic Activity at the Single-Cell Level by Using Enhanced Element Labeling-Catalyzed Reporter Deposition Fluorescence In Situ Hybridization (EL-FISH) and NanoSIMS. <i>Applied and Environmental Microbiology</i>, p. 3143–3150</li> <li>2. Introduction to Environmental Impact Assessment. 4th Edition. John Glasson, Riki Therivel, Andrew Chadwick. Routledge (2012).</li> <li>3. Environmental Impact Assessment. A. K. Shrivastava. APH Publishing, Jan-2003.</li> <li>4. Environmental Impact Assessment R R Barthwal New Age International, Jan-2002.</li> </ol>
2	<ul style="list-style-type: none"> <li>• Geo microbiology: Biofouling and Biocorrosion</li> <li>• Bioleaching               <ol style="list-style-type: none"> <li>a) Principles of Microbial Metal Leaching: Copper, Iron</li> <li>b) Leaching Mechanisms</li> <li>c) Models of Leaching Mechanisms</li> <li>d) Factors Influencing Bioleaching</li> <li>e) Bacterial Attachment on Mineral Surfaces</li> </ol> </li> </ul> <p><b>References:</b></p> <ol style="list-style-type: none"> <li>1. Klaus Bosecker (1997) Bioleaching: Metal solubilisation by microorganisms, <i>FEMS Microbiology reviews</i></li> <li>2. Axel Schippers and Wolfgang Sand (1998) Bacterial Leaching of Metal Sulfides Proceeds by Two Indirect Mechanisms via Thiosulfate or via Polysulfides and Sulfur, <i>Applied and Environmental Microbiology</i> p. 319–321 Vol. 65, No. 1</li> </ol>
3	<ul style="list-style-type: none"> <li>• Bioremediation: Definition, Role and pathways of plants &amp; Microbes in Bioremediation of:               <ol style="list-style-type: none"> <li>a) Hydrocarbons</li> <li>b) Industrial Wastes</li> <li>c) Xenobiotics</li> <li>d) Role of microorganisms in ocean processes</li> </ol> </li> </ul>

- Bioaugmentation:
  - a) microbial cultures and enzymes for bioaugmentation
  - b) Applications
- Biosorption
- Biomagnification: Role of Mercury in Biomagnification

**References:**

1. Ajay Singh, Owen P. Ward, 2004 edition, Applied Bioremediation and Phytoremediation (Soil Biology). Springer
2. Charles R. Lane, Paul Beales, Kelvin J. D. Hughes (2012). Fungal Plant Pathogens. 1st Edn. CABI Publishing
3. John Postgate, (1998). Nitrogen Fixation. Cambridge University Press
4. K. S. Bilgrami, H. C. Dube (1984). A textbook of modern plant pathology. 7th Edn.
5. Martin Alexander (1999). Biodegradation and Bioremediation. Academic Press
6. Matthew Dickinson, (2003). Molecular Plant Pathology. Garland Publishing Inc.
7. N. S. Subba Rao. (1995). Soil Microorganisms and Plant growth. 3rd Edn. Science Pub Inc
8. R. Barry King, John K. Sheldon, Gilbert M. Long, 1997 Practical Environmental Bioremediation: The Field Guide, 2nd Edn. CRC Press

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**Host- microbe interaction**

- Animal- microbe interaction:
  - a) Gastrointestinal System
  - b) Skin
  - c) Eyes (conjunctiva)
  - d) Upper respiratory tract
  - e) Urinary tract
  - f) Genital tract
  - g) Gut (termite)
  - h) Rumen
- Plant- microbe interaction:
  - a) Root symbionts
  - b) *Agrobacterium*
  - c) Phytopathogenic organisms
  - d) mycorrhizal fungi
  - e) nitrogen-fixing bacteria
  - f) plant-growth-promoting rhizobacteria (PGPR)

**References:**

1. Wim H van der Putten, John N Klironomos<sup>3</sup> and David A Wardle (2007). Microbial ecology of biological invasions. The ISME Journal 1, 28–37
2. Thomas L. Kieft and Karen A. Simmons (2015) Allometry of animal –microbe interactions and global census of animal-associated microbes. Proc. R. Soc. B
3. Ben Lugtenberg. (2015) Principles of Plant-Microbe Interactions. Springer international publishing.
4. Barbara Baker et al. (1997) Signaling in Plant-Microbe Interactions. Science. Vol. 276, Issue 5313, pp. 726-733

**M. Sc. – I MIC4205: Practical Course I: VIROLOGY AND ENVIRONMENTAL MICROBIOLOGY**

Unit No.	Practicals
1	<p><b>Virology (Plant Viruses)</b></p> <ul style="list-style-type: none"> <li>• Study of plant virus diseases: Collecting data and samples</li> <li>• Chloroplast agglutination test</li> <li>• Visit to an institute / industry related to Virology</li> </ul>
2	<p><b>Virology (Animal &amp; Bacterial Viruses)</b></p> <ul style="list-style-type: none"> <li>• Egg inoculation technique for virus cultivation by various routes-embryo, yolksac, allantoic fluid, amniotic cavity, chorioallantoic membrane</li> <li>• Animal virus titration by Hemagglutination test</li> <li>• Qualitative and quantitative detection of bacteriophage</li> <li>• One step growth curve of bacteriophage</li> </ul>
3	<p><b>Environmental Microbiology I</b></p> <ul style="list-style-type: none"> <li>• Host- microbe interaction: <i>In situ</i> observation of root nodules, crown galls</li> <li>• Biofilm and consortium preparation: Observation of biofilms on natural samples Development of biofilms and testing of biofilm production Consortium preparation from natural samples</li> </ul>
4	<p><b>Environmental Microbiology II</b></p> <ul style="list-style-type: none"> <li>• Effect of stress on microbial ecosystem: Effect of different concentrations of phosphates, nitrates, chlorides and heavy metals and different values of pH Calculation of dominance and diversity of microbial ecosystems upon exposure to stress</li> </ul>

**M. Sc. – I MIC4206: Practical Course II: BIostatISTICS & MICROBIAL METABOLISM**

<b>Unit 1</b>	<p><b>Biostatistics</b></p> <ul style="list-style-type: none"> <li>• Computer applications: Using datasheets, and sorting data with different parameters</li> <li>• Plotting graphs–bar charts, line graphs, pie charts, adding error bars</li> <li>• Statistical and analysis of data–Students t test, ANOVA, Chi square test ,F test using computer softwares (e.g .Microsoft Excel)</li> </ul>
<b>Unit 2</b>	<p><b>Isolation and Characterization of Anaerobic Bacteria</b></p> <ul style="list-style-type: none"> <li>• Different methods of isolation and cultivation of anaerobic bacteria</li> <li>• Isolation of Aflatoxin producing organism</li> <li>• Detection of Aflatoxin in food / culture</li> </ul>
<b>Unit 3</b>	<p><b>Microbial Metabolism I</b></p> <ul style="list-style-type: none"> <li>• Isolation and characterization of (as nitrogen fixers) <i>Azospirillum</i> and detection of IAA by <i>Azospirillum</i></li> <li>• Detection of siderophore production by <i>Azospirillum</i> and <i>Pseudomonas</i></li> </ul>
<b>Unit 4</b>	<p><b>Microbial Metabolism II</b></p> <ul style="list-style-type: none"> <li>• Isolation and characterization of phosphate solublizing bacteria</li> <li>• Isolation and characterization of chitin degrading bacteria</li> <li>• Isolation and characterization of cellulose degrading bacteria</li> <li>• Isolation and characterization of pesticide degrading bacteria</li> </ul>

## MIC4207: SELF STUDY COURSE: SCIENTIFIC COMMUNICATION - II

<b>Unit</b>   <b>1</b>	<b>Scientific communication</b> <ul style="list-style-type: none"><li>• Writing a pedagogical (academic) article on a scientific theme (Review)</li><li>• Oral presentation: Critically commenting on a manuscript (Research Paper/Article)</li></ul> <b>References:</b> <ol style="list-style-type: none"><li>1. Alley, M. 1996. The craft of scientific writing, 3<sup>rd</sup> edition. Prentice Hall, NJ. [and accompanying website: <a href="http://filebox.vt.edu/eng/mech/writing/">http://filebox.vt.edu/eng/mech/writing/</a>]</li><li>2. Day, R. 1998. How to write and publish a scientific paper, 5th edition. Orynx Press.</li><li>3. Day, R. 1995. Scientific English: A guide for scientists and other professionals, 2nd edition. Orynx Press</li></ol>
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