

BHARATHIAR UNIVERSITY :COIMBATORE – 641 046

M.Phil./ Ph.D. in Applied Environmental Science

(DRDO-DEBEL)

(w.e.f. 2009-2010 and onwards)



**GOVT. OF INDIA, MINISTRY OF DEFENCE,  
DEFENCE RESEARCH & DEVELOPMENT ORGANISATION,  
DEFENCE BIOENGINEERING & ELECTROMEDICAL  
LABORATORY (DRDO - DEBEL)  
PB No.9326, C.V.RAMAN NAGAR,  
BANGALORE –560 093.**

Phone : 080-25058435

Fax : 080-25282011

Gram : DEBEL

PART-I SYLLABUS

PAPER I : Research Methodology

PAPER II : Applied Environmental Science

PAPER III : Special Papers

1. Adsorption Studies of Carbon Materials

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**M.Phil./ Ph.D. Applied Environmental Science – Syllabus for FT/PT**

**PAPER – I : RESEARCH METHODOLOGY**

**Unit – I**

**Research Material Collection, Preparation & Presentation**

Methods of literature collection, experimental design, planning and execution of investigation – preparation of research and review articles for journals, thesis, research proposals – objectives, preparation, presentation and selective evaluation.

**Unit – II**

**Statistical Analysis**

Basic elements and tools of statistical analysis – Probability, sampling measurement and distribution of attributes – Approaches to development of models – Test of significance – Analysis of variance – one way and two way ANOVA – Regression and correlation – Linear, simple and multiple regression models – software in statistics – XPSS, design expert.

**Unit – III**

**Spectroscopy – Principle , Instrumentation and Application**

UV-Visible NIR spectrophotometer, Inductively Coupled Plasma (ICP) Spectroscopy, Flame Photometry, FTIR and Photoluminescence Spectrophotometer

**Unit – IV**

**Chromatography – Principle, Instrumentation & Application**

Paper, thin-layer Chromatography, Gas Chromatography – Mass Spectrometer, High-performance Liquid Chromatography and Ion Exchange Chromatography.

**Unit – V**

**Characterization of Nanomaterials**

Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM), X-ray Diffraction (XRD), Differential Scanning Calorimeter (DSC)/TGTA and Surface Area Analyzer.

**References:**

1. Statistics in Biology, Bliss, G.I.(1970). McGraw Hill, Vol I and II, New delhi.
2. Environmental Instrumentation, Fritschen, L.J. and Gay.L.W. (1979). Springer-Verlag, New york.
3. Analytical Biochemistry. Holme.D.L. and Peck H. (1983). Longman, London.
4. Hawk's Physiological chemistry, 14<sup>th</sup> Ed, Oser, B.L. (1965), Tata McGraw Hill, New Delhi.

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**PAPER– II : Applied Environmental Science**

**Unit – I**

**Introduction**

Concept and scope of Environmental chemistry – Environmental segments – Types of pollutants - chemical and photochemical reactions in atmosphere – Green house effect – role of microorganism – Soil pollution – wastes and pollutants in soil – Solid waste management.

**Unit – II**

**Air Pollution**

Introduction - Sources and classification – Air pollutant accidents - Effects of oxides of carbon, sulfur, nitrogen on Humans. Animals, plants – Economic effects – sampling procedures – Analytical methods – Control of air pollution by settling chamber, filters, electrostatic precipitators, scrubbers.

**Unit – III**

**Water Pollution**

Introduction - Sources – organic pollutants - contaminant processes in surface waters – waste water treatment – sampling procedures and preservation – procedures for analyses of water quality parameters.

**Unit – IV**

**Instrumental techniques**

Conductivity Meter, pH meter, Chemiluminescence, High performance liquid chromatography, Ion chromatography and Ion selective electrodes.

**Unit – V**

**Legislation and Regulations**

The water (Prevention and Control of Pollution) Act, 1974, as amended up to 1988 – The Air (Prevention and Control of Pollution) Act, 1981, as amended by Amendment Act, 1987 – Environment Impact Assessment Act 2006- The Environment (Protection) Act, 1986 – Hazardous Wastes (Management and Handling rules, 1989

**References:**

- 1.Fundamentals of Environmental Engineering – Danny D. Reible.
2. Air Pollution – M N Rao, H V N Rao.
- 3.Pollution Control Acts, Rules and Notifications
4. Environmental Sciences – A K De

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**PAPER– III : ADSORPTION STUDIES OF CARBON MATERIALS**

**UNIT – I**

**Preparation of Adsorbent Materials**

Activated carbon (AC) – Granular AC, AC Cloth, AC Membranes and AC Aerogels. Determination of factors affecting adsorption: pH, adsorbate concentration, particle size, adsorbent concentration, adsorbent properties, flow rate, bed volume, temperature and pressure.

**UNIT – II**

**Properties of Adsorbent Materials**

Structural parameters and models – Physico-chemical, mechanical and surface properties – Adsorption and wetting characteristics.

**Unit – III**

**Adsorptive Removal of Toxic Gases (CO, NO<sub>x</sub>, SO<sub>x</sub>, H<sub>2</sub>S & hydrocarbons)**

Material for conventional and non-conventional gas adsorption – catalytic decomposition; Desulphurization methods – Regenerative and non-regenerative alkaline processes – Adsorption by liquids.

**Unit IV**

**Adsorption Analysis**

Kinetics of adsorption & Adsorption rate equations, Isotherms – Langmuir, Freundlich and B.E.T., Mechanism of adsorption of cations, anions, organics and surfactants – Electrostatic attraction / Repulsion model, ion exchange model, James-Healy model and surface complex models. Batch & Column dynamics and multisorbate sorption.

**Unit – V**

**Applications**

Direct and indirect measurement of adsorption of gases and vapors on active carbon using various techniques - Applications of active carbon based on its reactivity and catalytic properties – Laboratory and various uses – Industrial applications

**References:**

- 1.Active carbon - Milan Smisek, Slavoj cerny
- 2.Carbon fiber – Jean-Baptiste Donnet and Roop chand Bansal
- 3.Physical chemistry – Atkins
- 4.Adsorption & Adsorption processes by Ruthven.;
- 6.Sorption & Biosorption by B. Volesky.

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