



**RK University (Pre-registration coursework for PhD program)**

**Program - PhD (Environmental Engineering)**

**Concerned Dean - Dr. Ajit Kumar Shukla (email - [ajit.shukla@rku.ac.in](mailto:ajit.shukla@rku.ac.in))**

Sr. No.	Subject	Contents	Method of	Credits
1.	Research Methodology	As per syllabus mentioned below	Written examination (3 hrs)	4
2.	Subject of specialization:* 1. Solid And Hazardous Waste Management 2. Industrial Waste Management 3. Environmental Impact Assessment And Audit 4. Environmental Laws And Legislation 5. Environmental Systems Modeling And Application	Research topic specific	Written examination (3 hrs)	4
3.	Review of literature	Review of literature for the PhD research topic	Presentation + Detailed report in hard copy	3
Total				11

**(\*Shall be decided by the Dean of Faculty, individually, for each PhD scholar)**

**Notes -**

1. The admission process of PhD program will comprise of 2 stages viz. (a) admission to PhD program (b) final registration in PhD program.
2. A successful PhD candidate (RAT examination) will be admitted to PhD program after paying admission fees (Rs. 60000/-) and upon allocation of a PhD guide by RK University.
3. An admitted PhD candidate will have to submit synopsis and presentation of his/her actual research project (in consultation with the PhD guide approved and allocated by RK university) before Doctoral Research Committee (DRC) within 6 months from date of admission (date will be declared by university).
4. An admitted PhD candidate will be registered after earning minimum of 11 credits as per above mentioned course-work structure.
5. The candidate will acquire credit of a subject on passing the examination that will be conducted at the end of 6 months (date will be declared by university).
6. On acquiring required credits, an admitted candidate will be issued a certificate of registration (along with project title) by RK University.

**Detailed syllabus****Research:**

Meaning, purpose, Types, (Educational, Clinical, Experimental, historical descriptive, Basic applied and Patent oriented Research) and objectives of research, phases of research.

**Research Design:**

Review of Research Literature: Purpose and use of literature review, locating relevant information, use of library & electronic databases, preparation & presentation of literature review, research article reviews, theoretical models and frame work. Identification of gaps in research, formulation of research problem, definition of research objectives.

**Documentation:**

- a. "How" of documentation
- b. Techniques of documentation
- c. Importance of documentation
- d. Use of computer packages in documentation

**Research Publication:**

Thesis, Research paper, Review Article & Technical Reports: Organization of thesis and reports, formatting issues, citation methods, references, effective oral presentation of research. Quality indices of research publication: impact factor, immediacy factor, H- index and other citation indices

**Presentation (especially for oral presentation):**

Importance and types of different skills, contained, format of model, introduction, Poster, Gestures, eye contact, facial, expressions, stage fright, volume of pitch, speed, pause & language, Visual aids & seating, Questionnaire etc.

**Cost analysis of the project:**

cost incurred on raw materials, Procedure, instrumentations and clinical trials.

**Sources for procurement of research grants:**

International agencies, government and private bodies.

**Industrial-institution interaction:**

Industrial projects, their feasibility reports, interaction with industries.

**Research Ethics and Morals:**

Issues related to plagiarism, collaborative models and ethics, acknowledgements. Intellectual Property Rights: copy rights, copy left: patents, Industrial designs, Trademarks.

### **Reference Books:**

1. Research Methodology, Methods & Techniques, C. R. Kothari, Vishwa Prakashan
2. Research Methods- A Process of Inquiry, Graziano, A.M., Raulin, M.L, Pearson Publications.
3. How to Write a Thesis;, Murray, R. Tata McGraw Hill
4. Writing For Academic Journals, Murray, R., McGraw Hill International.
5. Writing for Publication, Henson, K.T., Allyn & Bacon.
6. Research Methodology by Bhattacharyya Excel Books 2nd Edition.
7. What is this thing called Science, Chalmers, A.F., Queensland University Press.
8. Methods & Techniques of Social Research, Bhandarkar & Wilkinson, Himalaya publications.
9. Doing your Research project, Bell J., Open University Press, Berkshire.
10. A Handbook of Academic Writing, Murray, R. and Moore, S., Tata McGraw Hill International.
11. Business Research Methods Donald R. Cooper and Pamela S.Schindler Business Research Methods Tata McGraw Hill Publishing Company Ltd
12. Research Methodology: A Guide for Researchers in Management and Social Sciences Taylor, Sinha & Ghoshal

<b>Course Title</b>	<b>Solid And Hazardous Waste Management</b>
<b>Detailed syllabus</b>	
<p><b><u>Introduction</u></b> Solid waste sources - nature and characteristics - Quantities and Qualities - generation rates – Potential of disease - nuisance and other Problems.</p> <p><b><u>Collection and Storage</u></b> Solid waste management – Functional elements of solid waste-on-site storage, collection and separation. – Containers and its location – collection systems- vehicle routing- route balance- transfer station - Processing- recovery and reuse.</p> <p><b><u>Disposal</u></b> Disposal methods – sanitary land filling, planning, site selection, design. Monitoring Closure and post closure monitoring – Other methods like incineration, pyrolysis, composting, biological digestion,</p> <p><b><u>Hazardous Waste Management</u></b> Introduction to hazardous waste – Definition, characterization and composition – TCLP test – The magnitude of problem – Risk assessment – Storage and transportation of hazardous waste –Labeling of hazardous waste – Physical, Chemical and Biological treatment of hazardous waste – Bioremediation of hazardous waste – Treatment of nuclear waste and Radio-active waste.</p> <p><b><u>Legislation</u></b> Biomedical waste and BMW-98 Rules - MSW-2000 Rules – Legislation for E-waste and radioactive waste.</p>	
<b><u>Reference Books:</u></b>	
<ol style="list-style-type: none"> <li>1. David Rimbers, "Municipal Solid Waste Management: Pollution Technologies Review", Noyes Data Corporation, London. (1990)</li> <li>2. Charles A. Wentz, "Hazardous Waste Management", McGraw Hill International Edition, New York. (1995)</li> <li>3. Tchobanoglous G, "Solid Wastes: Engineering principles and Management issues", McGraw Hill Book Company, Delhi. (1977)</li> <li>4. Michael D. Lagrega, Phillip L. Buckingham, Jeffrey C. Evans, "Hazardous Waste Management" McGraw Hill, New York. (1994)</li> <li>5. Gaynor W. Dawson, Basil W. Mercer, "Hazardous Waste Management" Wiley Interscience, New York. (1986)</li> </ol>	

<b>Course Title</b>	<b>Industrial Waste Management</b>
<b>Detailed syllabus</b>	
<p><b><u>Sources and characteristic</u></b>  Industrial waste source, Nature and characteristics, quantity and quality of industrial wastes and their impact on the environment, waste volume reduction, waste strength reduction, neutralization, removal of suspended and colloidal solids, removal of inorganic and organic dissolved solids, disposal of sludge solid – treatment of cyanide waste – heavy metal and Radio activity.</p> <p><b><u>Management</u></b>  Management of industrial waste for various industries like dairy, sugar, paper, distillery, textile, tannery, food processing, fertilizer, Pharmaceutical industrial.</p> <p><b><u>Recent Trends</u></b>  Development of integrated treatment for waste water – physico chemical treatment tertiary treatment methodologies - recent trends in clean technologies – zero polluting industry concept – Reuse and recycle of Waste water.</p>	
<b><u>Reference Books:</u></b>	
<ol style="list-style-type: none"> <li>1. Nemerow, N.L. Liquid waste of Industries, Addison Wesley. 1996</li> <li>2. Rao M N and Datta A K Wastewater Treatment, Oxford &amp; IBH Publishing Co. Pvt. Ltd, New Delhi.</li> <li>3. Eckenfelder. Industrial Water Pollution Control, McGraw-Hill.</li> <li>4. Metcalf and Eddy, (1995) Wastewater Engineering-treatment, Disposal, Refuse, T.M.H. Edition, New Delhi.</li> <li>5. Manual on water supply &amp; treatment (1991) 3rd Ed. Pub : CPH &amp; Env. Engg. Organization, Ministry of Urban Development, Govt. of India, New Delhi.</li> </ol>	

Course Title	Environmental Impact Assessment And Audit
<b>Detailed syllabus</b>	
<p><b><u>Introduction:</u></b> Environmental Assessment process, objectives of EIA, Terminology, Hierarchy in EIA, Historical Review of EIA, Concepts related to EIA, Basic data collection for EIA.</p> <p><b><u>Legislation and Procedures:</u></b> National Environmental Policy Act and Implementation, EIA legislative requirements and administrative procedures in India/Indian States, EIA notification 2006</p> <p><b><u>Techniques and Methodology:</u></b> Description of the environmental setting, OWL Methods of Impact Analysis, Environmental risk assessment, baseline data collection for EIA.</p> <p><b><u>Public Participation</u></b> in environmental decision making, regulatory requirement, techniques, advantages and disadvantages of public participation.</p> <p><b><u>PREPARATION MODULES :EIA</u></b></p> <p><b><u>Prediction and Assessment of Impacts</u></b> on Air, Water, Noise, Biological, Cultural and socio-economic Environment, Mining, blasting.</p> <p><b><u>Case studies of EIA</u></b> for Industries like Oil, Petrochemical, iron and steel, fertilizer, sugar and distillery, projects of road/dams and housing etc.</p> <p><b><u>Environment Management Plan:</u></b> Planning, selection of appropriate procedures, Introduction to Environmental budget, to minimize environmental Impacts.</p> <p><b><u>Environmental Audit:</u></b> Definition of Environment Audit and its importance for industries. Types of audits, General audit methodology and basic structure of audit. Elements of an audit process and its importance. Concept of ISO 14000.</p> <p>Requirements of Rule 14 for Environmental Audit under Environmental protection Act 1986, Definitions of (a). Signatory, b. Consumption Audit, (c). Pollution audit, (d). Hazardous audit, (e). Solid waste audit, (f.) Disposal audit, (g.) Cost audit, (h.) Investment audit, (i.) Voluntary.</p>	
<b><u>Reference Books:</u></b>	
<ol style="list-style-type: none"> <li>1. Larry W. Canter," Environment Impact Assessment", McGraw-Hill Book Company, New York</li> <li>2. G.J. Rau and CD. Weeten, "Environmental Impact Analysis Hand book, McGraw Hill, 1980.</li> <li>3. Vijay Kulkarni and T V Ramchandra. "Environmental management" Capital Publishing Co</li> <li>4. Mhaskar A.K., "Environmental Audit" Enviro Media Publications.</li> <li>5. S.K. Dhameja, "Environmental Engineering and Management" S. K. Kalaria and Sons Publishers.</li> </ol>	

Course Title	Environmental Laws And Legislation
<b>Detailed syllabus</b>	
<p><b><u>Background of Environmental Legislation:</u></b> Significance and Objectives of Legislation for Environmental Engineers. Provisions for Environmental protection and legislation in the Constitution of India, Evolution of Environmental Legislation in India.</p> <p><b><u>Role of Government Agencies in Environmental Legislation:</u></b> Policy decision stages in environmental protection, Environmental standards in India, Role and functions of various agencies like MoEF, CPCB, DoEF, SPCB / PCC.</p> <p><b><u>National Acts &amp; Rules for Environmental Protection</u></b> Water Act-1974, Water Cess Rules-1977, Air Act-1981, Environment Protection Act-1986, Various Rules framed under Environment Protection Act-1986, Hazardous Waste Rules-1989, EIA Notification-1994 and its Amendments, Bio- medical waste Rules-1998 and Batteries Rules-2001.</p> <p><b><u>Implementation of Environmental Legislation</u></b> Environmental Clearance, NOC, Water Consent, Air Consent, Hazardous Waste Authorization.</p> <p><b><u>International Environmental Legislation:</u></b> US EPA, UN international conference-1972, Kyoto and Montreal Protocols, Doha convention.</p>	
<b><u>Reference Books:</u></b>	
<ol style="list-style-type: none"> <li>1. P. K. Goel and K. P. Sharma, "Environmental guidelines and standards in India", Technoscience Publications, Jaipur. (1996)</li> <li>2. Paras Diwan &amp; Peeyushi Diwan, "Environment Administration law and judicial aptitude", Deep and Deep publishers.</li> <li>3. Gurdip Singh, "Environmental law in India", Macmillan India, New Delhi. (2005)</li> <li>4. Kailash Thakur, "Environmental protection law and policy in India", Deep and Deep publishers. (1997)</li> <li>5. Relevant MoEF Notifications and CPCB / GPCB Acts &amp; Rules.</li> </ol>	

<b>Course Title</b>	<b>Environmental Systems Modeling And Application</b>
<b>Detailed syllabus</b>	
<p><b><u>Introduction</u></b> Mathematical modelling and simulation, Defining systems and its components, Types of models and their applications.</p> <p><b><u>Models for Fate and Transport of Contaminants</u></b> Modelling of volatilization, chemical transformations, sorption/ desorption, photochemical transformations, biological transformations. Brief review of mass, momentum and energy balance, advection, molecular diffusion, dispersion, their application in modelling of rivers, lakes, sediments, wetlands, subsurface flow and transport, air pollution modelling</p> <p><b><u>Introduction to Soft Computing Techniques</u></b> Fuzzy set theory and logic, Fuzzy MCDM and FRBS, simple applications in environmental engineering. Neural networks and Genetic Algorithms</p> <p><b><u>GIS Applications in Environmental Engineering</u></b> Introduction to GIS, concepts and data base structure, introduction to GIS software. Introduction to Remote Sensing. Applications in Environmental Engineering.</p>	
<b><u>Reference Books:</u></b>	
<ol style="list-style-type: none"> <li>1. Ramaswami, A, Milford, J B, Small, M. J. Integrated Environmental Modeling - Pollutant Transport, Fate, and Risk in the Environment John Wiley &amp; Sons, 2005.</li> <li>2. Burrough, P.A. and McDonnell, R.A., Principles of Geographical Information Systems, Oxford University Press, 1998.</li> <li>3. Snape, J.B., Dunn, I.J. Ingham J and Prenosil J Dynamics of environmental bioprocesses, modelling and simulation Weinheim: VCH, 1995.</li> <li>4. International Water Association - Activated sludge modelling ASM1 and ASM2</li> <li>5. Chapra S C, Surface Water Quality Modeling, McGraw-Hil, Inc., New York, 1997.</li> </ol>	