

FLORIDA ATLANTIC UNIVERSITY™

Graduate Programs—COURSE CHANGE REQUEST¹

UGPC APPROVAL _____
 UFS APPROVAL _____
 SCNS SUBMITTAL _____
 CONFIRMED _____
 BANNER POSTED _____
 CATALOG _____

DEPARTMENT: CIVIL, ENVIRONMENTAL AND GEOMATICS ENGINEERING	COLLEGE: ENGINEERING AND COMPUTER SCIENCE
COURSE PREFIX AND NUMBER: ENV 6668	CURRENT COURSE TITLE: Environmental Systems and Processes
CHANGE(S) ARE TO BE EFFECTIVE (LIST TERM):	_____ TERMINATE COURSE (LIST FINAL ACTIVE TERM):
CHANGE TITLE TO: CHANGE PREFIX FROM: TO: CHANGE COURSE NO. FROM: TO: CHANGE CREDITS ² FROM: TO: CHANGE GRADING FROM: TO: CHANGE DESCRIPTION TO:	CHANGE PREREQUISITES/MINIMUM GRADES TO*: NONE CHANGE COREQUISITES TO*: CHANGE REGISTRATION CONTROLS TO: *Please list both existing and new pre/corequisites, specify AND or OR, and include minimum passing grade. MINIMUM PASSING SCORE IS A C
Attach syllabus for ANY changes to current course information.	
Should the requested change(s) cause this course to overlap any other FAU courses, please list them here.	Please consult and list departments that might be affected by the change(s) and attach comments. ³

Faculty contact, email and complete phone number:
 Dr. Frederick Bloetscher, P.E.
 Building 36, Room 219
 Telephone: 561-297-0744,
 E-mail: h2o_man@bellsouth.net or fbloetsc@fau.edu

Approved by: Department Chair: _____ College Curriculum Chair: _____ College Dean: _____ UGPC Chair: _____ Graduate College Dean: _____ UFS President: _____ Provost: _____	Date: 9/29/14 7/29/14 10/1/2014 10/8/14 10-15-14	<ol style="list-style-type: none"> 1. Syllabus must be attached; see guidelines for requirements: www.fau.edu/provost/files/course_syllabus.2011.pdf 2. Review Provost Memorandum: Definition of a Credit Hour www.fau.edu/provost/files/Definition_Credit_Hour_Memo_2012.pdf 3. Consent from affected departments (attach if necessary)
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Email this form and syllabus to UGPC@fau.edu one week before the University Graduate Programs Committee meeting so that materials may be viewed on the UGPC website prior to the meeting.

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1. Course title/number, number of credit hours	
Environmental Systems and Processes (ENV 6668)	3 credit hours
2. Course prerequisites, co-requisites, and where the course fits in the program of study	
Prerequisite: None Co-Requisites: None.	
This is a course covers physical, chemical, and biological processes, reactor theory, particle transport, mass transfer, mixing, advection, dispersion, diffusion, sorption, phase transfer..	
3. Course logistics	
Term: Fall 2016 This is a classroom lecture course Class location and time: W. 7:10 pm – 10:00 pm	
4. Instructor contact information	
Instructor's name	Dr. Frederick Bloetscher, PE, Associate Professor
Office address	Engineering West (EG-36) Room 219
Office hours	T W TH 2-330
Telephone no.	239-250-2423
Email address	h2o_man@bellsouth.net
5. TA contact information	
Not applicable	
6. Course description	
The course involves evaluating infrastructure systems (water, sewer, stormwater, roads, bridges, rail, power) to identify concepts on repair, replacement and maintenance, including dollars to spend on same.	
TOPICS	<ol style="list-style-type: none"> 1. Water supplies 2. Water rights 3. Sustainability 4. Reservoirs 5. Chemical Decay 6. Mass Balance 7. Nutrients 8. Thermodynamics 9. Streeter Phelps 10. Toxicity 11. 1, 2 and 3D dispersion
7. Course objectives/student learning outcomes/program outcomes	
COURSE OBJECTIVES	<ol style="list-style-type: none"> I. Present the fundamental principles applied in the analysis, design, modeling, and operation of engineered and natural solutions for environmental engineering. II. Present the fundamental mechanisms of mass transport and biological/physical/chemical interactions underlying environmental engineering

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	processes.														
	II. Expose students to the complex interaction between environmental problems and the needs of society.														
PROGRAM EDUCATIONAL OBJECTIVES	A. Practice civil engineering within the general areas of structural engineering, transportation engineering, geotechnical engineering, and water resources/environmental engineering in the organizations that employ them.	H													
	B. Advance their knowledge of civil engineering, both formally and informally, by engaging in lifelong learning experiences including attainment of professional licensure, and/or graduate studies	H													
	C. Serve as effective professionals, based on strong interpersonal and teamwork skills, an understanding of professional and ethical responsibility, and a willingness to take the initiative and seek progressive responsibilities.	H													
	D. Participate as leaders in activities that support service to, and/or economic development of, the region, the state and the nation	H													
8. Course evaluation method (note percentages subject to change)															
Mid Term Exam	30%	Note: The minimum grade required to pass the course is C.													
Final Exam	30%														
Project	30%														
Homework	10%														
9. Course grading scale															
<p>Course grades are assigned according to the attached Department of Civil Engineering Grading Guidelines. Assignments and reports must be prepared according to the required formats (see attached documents: (a) Assignment Presentation and (b) Technical/Project/Laboratory Report Writing). Additional requirements may be given by the instructor. NOTE: you cannot pass the class if you fail both exams regardless of you grade.</p> <table border="1" style="width: 100%;"> <thead> <tr> <th style="text-align: left;">Grade</th> <th style="text-align: left;">Qualitative description of achievement</th> </tr> </thead> <tbody> <tr> <td>A</td> <td rowspan="2">Extensive achievement of stated outcomes. Student is capable of working with little supervision in this area and/or pursuing advanced studies in this area of civil engineering.</td> </tr> <tr> <td>A-</td> </tr> <tr> <td>B+</td> <td rowspan="2">Good achievement of stated outcomes. Student is capable of working under moderate supervision in this area of civil engineering.</td> </tr> <tr> <td>B</td> </tr> <tr> <td>B-</td> <td rowspan="2">Satisfactory achievement of stated outcomes. Student is capable of working under close supervision in this area of civil engineering. Minimum grade satisfying CE curriculum requirements.</td> </tr> <tr> <td>C</td> </tr> <tr> <td>D-</td> <td>Insufficient achievement of stated outcomes. Student is not capable of practice in this area of civil engineering. Course must be repeated and student may not enroll, under any circumstances, for a subsequent course requiring this course as a prerequisite.</td> </tr> </tbody> </table>			Grade	Qualitative description of achievement	A	Extensive achievement of stated outcomes. Student is capable of working with little supervision in this area and/or pursuing advanced studies in this area of civil engineering.	A-	B+	Good achievement of stated outcomes. Student is capable of working under moderate supervision in this area of civil engineering.	B	B-	Satisfactory achievement of stated outcomes. Student is capable of working under close supervision in this area of civil engineering. Minimum grade satisfying CE curriculum requirements.	C	D-	Insufficient achievement of stated outcomes. Student is not capable of practice in this area of civil engineering. Course must be repeated and student may not enroll, under any circumstances, for a subsequent course requiring this course as a prerequisite.
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10. Policy on makeup tests, late work, and incompletes															
<p>Exams will be given only at the scheduled times and places. No one is exempt from the final examination. <i>Makeup tests</i> are given only if there is solid evidence of a medical or otherwise serious emergency that prevented the student of participating in the exam. Makeup exams will be administered and proctored by department personnel unless there are other pre-approved arrangements.</p>															

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Late work is not acceptable.
Incomplete grades are against the policy of the department. Unless there is solid evidence of medical or otherwise serious emergency situation, incomplete grades will not be given.
Attendance to class is required. You are expected to attend and participate in all class sessions. Final grades will be reduced by one letter for every three (3) unexcused absences (as determined by the instructor).

11. Special course requirements

none.

12. Classroom etiquette policy

1. Cell phones and beepers should have the ringers turned off as a courtesy to the instructor and your fellow classmates.
 2. Computers must be closed and turned off in class
 3. You can leave only on breaks
 4. Exams will be given only at the scheduled times and places. No make-ups, except in documented emergencies. No one is exempt from the final examination.
 5. Attendance to class is required. You are expected to attend and participate in all class sessions. Final grades will be reduced by one letter for every three (3) unexcused absences (as determined by the instructor). Attendance to at least one (1) professional meeting is required.
 6. You are expected to complete the assigned reading prior to the date indicated on the class schedule, to do all homework assignments, and to participate fully in the group projects.
 7. Assignments are due at the beginning of class on the date indicated on the assignment sheet.
- University policy requires that in order to enhance and maintain a productive atmosphere for education, personal communication devices, such as cellular phones and laptops, are to be disabled in class sessions.
You are expected to complete the assigned reading prior to the date indicated on the class schedule, to do all homework assignments, and to participate fully in the group projects

13. Disability policy statement

In compliance with the Americans with Disabilities Act (ADA), students who require special accommodations due to a disability to properly execute coursework must register with the Office for Students with Disabilities (OSD) located in Boca Raton campus, SU 133 (561) 297-3880 and follow all OSD procedures.

14. Honor code policy

Consultation with your classmates on assignments is expected and encouraged; however what you turn in must be your own work. Representing the work of others as your own is unethical and may result in sanctions (see the FAU Policy on Academic Honesty). FAU is committed to a policy of honesty in academic affairs. The instructor's duty is to pursue any reasonable allegation, taking action where appropriate, as described in the appropriate section of the FAU Catalog (<http://www.fau.edu/ug-cat/academic.htm#irregular>) and the Florida Administrative Code. Please be advised that the copying of material from the world wide web or any other written material is considered plagiarism and is also a breach of the Honor Code.

Students at Florida Atlantic University are expected to maintain the highest ethical standards. Academic dishonesty is considered a serious breach of these ethical standards, because it interferes with the university mission to provide a high quality education in which no student enjoys unfair advantage over any other. Academic dishonesty is also destructive of the university community, which is grounded in a system of mutual trust and place high value on personal integrity and individual responsibility. Harsh penalties are associated with academic dishonesty. See University Regulation 4.001 at www.fau.edu/regulations/chapter4/4.001_Honor_Code.pdf.

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Regulation 4.001 Code of Academic Integrity

(1) Purpose. Students at Florida Atlantic University are expected to maintain the highest ethical standards. Dishonesty is considered a serious breach of these ethical standards, because it interferes with the University mission to provide a high quality education in which no student enjoys an unfair advantage over any other. Dishonesty is also destructive of the University community, which is grounded in a system of mutual trust and places high value on personal integrity and individual responsibility.

(2) Definitions. The FAU Code of Academic Integrity prohibits dishonesty and requires a faculty member, student, or staff member to notify an instructor when there is reason to believe dishonesty has occurred in a course/program requirement. The instructor must pursue any reasonable allegation, taking action where appropriate. Examples of academic dishonesty include, but are not limited to, the following:

(A) Cheating

1. The unauthorized use of notes, books, electronic devices, or other study aids while taking an examination or working on an assignment.
2. Providing unauthorized assistance to or receiving assistance from another student during an examination or while working on an assignment.
3. Having someone take an exam or complete an assignment in one's place.
4. Securing an exam, receiving an unauthorized copy of an exam, or sharing a copy of an exam.

(B) Plagiarism

1. The presentation of words from any other source or another person as one's own without proper quotation and citation.
2. Putting someone else's ideas or facts into your own words (paraphrasing) without proper citation.
3. Turning in someone else's work as one's own, including the buying and selling of term papers or assignments.

(C) Other Forms of Dishonesty

1. Falsifying or inventing information, data, or citations.
2. Failing to comply with examination regulations or failing to obey the instructions of an examination proctor.
3. Submitting the same paper or assignment, or part thereof, in more than one class without the written consent of both instructors.
4. Any other form of academic cheating, plagiarism, or dishonesty.

(3) Procedures.

(A) If the instructor determines that there is sufficient evidence to believe that a student engaged in dishonesty, the instructor will meet with the student at the earliest possible opportunity and provide notice to the student of the instructor's perception of the

facts, the charges against the student, and the sanction. The instructor may not remove the student from the course until the appeal process has come to a conclusion.

(B) If, after this meeting, the instructor continues to believe that the student engaged in dishonesty, the instructor will provide the student written notice of the charges and the penalty. A copy of this statement shall be sent to the chair of the department or director of the school/program administering the course.

(C) The student is entitled to an opportunity to be heard at a meeting with the instructor and chair/director to review and discuss the instructor's charges/statement. Such request for a meeting must be made in writing and received by the chair/director within five (5) business days of receipt of the instructor's charges/statement. The purpose of the meeting is to discuss the facts and to advise the student of the appeal process. The chair/director will provide the student, the instructor, and the dean of the college administering the course a summary of both the student's position and the instructor's position.

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(D) The student may appeal in writing to the dean of the college administering the course. The appeal must be received by the dean within five (5) business days of receipt of the chair/director's summary from the review meeting. The dean will convene a Faculty-Student Council ("Council"), which will be composed of the dean (or designee), two faculty members, and two students. The dean (or designee) will act as chair of the Council, direct the hearing, and maintain the minutes and all records of the appeal hearing, which will not be transcribed or recorded. The hearing is an educational activity subject to student privacy laws/regulations, and the strict rules of evidence do not apply. The student may choose to be accompanied by a single advisor, but only the student may speak on her/his own behalf. The student and instructor may present testimony and documents on his/her behalf. Additional witnesses may be permitted to speak at the dean's (or designee's) discretion and only if relevant and helpful to the Council. The Council will deliberate and make a recommendation to the dean to affirm or void the instructor's findings of academic dishonesty. The dean (or designee) will inform the student and instructor in writing of his/her findings of academic dishonesty after receipt of the Council's recommendation.

(E) The student may request an appeal in writing of the dean's findings of academic dishonesty to the University Provost (or designee) and include relevant documentation in support of such appeal. The University Provost (or designee) will notify the student, dean, and instructor of his/her decision in writing. This decision by the Provost (or designee) constitutes final University action.

(F) If there is a finding that the Code of Academic Integrity has been violated, the chair will notify the University Registrar that the following notation be included on both the student's official transcript and on the student's internal record: "Violation of Code of Academic Integrity, University Regulations 4.001." If such violation is appealed and overturned, the dean or University Provost (or their designees) will notify the University

Registrar that such notation should be removed from the student's transcript and internal record.

(4) Penalties.

(A) The instructor will determine the penalty to be administered to the student in the course. Penalty grades cannot be removed by drop, withdrawal, or forgiveness policy. Students should be aware that, in some Colleges/programs, failure in a course or a finding of dishonesty may result in other penalties, including expulsion or suspension from the College/program.

(B) In the case of a first offense, the student may elect to complete a peer counseling program administered by the Division of Student Affairs by the end of the semester following the semester in which the dishonesty occurred. Upon successful completion of this program, the notation regarding violation of the Code of Academic Integrity will be expunged from the student's official transcript. The grade, however, will remain unchanged and cannot be removed by drop or forgiveness policy. Also, the notation will remain in internal University student records.

(C) In the case of a repeat offense, even if the notation of violation of the Code of Academic Integrity from the first offense had been expunged from the official transcript as a result of successful completion of the peer counseling program, the student will be expelled from the University.

Specific Authority: Article IX of the Florida Constitution, 1001.706, 1001.74 F.S., Board of Governors Regulations 1.001, 6.010, and 6.0105. History—New 10-1-75, Amended 12-17-78, 3-28-84, Formerly 6C5-4.01, Amended 11-11-87. Formerly 6C5-4.001. Amended 5-26-10

See University Regulation 4.001 at www.fau.edu/regulations/chapter4/4.001_Honor_Code.pdf.

15. Required texts/reading

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First 2 textbooks are required for both semesters of Civil Engineering Design

- Clark, M.M. *Transport Modeling for Environmental Engineers and Scientists*. Wiley-Interscience, New York, 1996.
- Fischer, H.B., *Mixing in Inland and Coastal Waters*, Academic Press, New York, 1979
- Logan, B.E. *Environmental Transport Processes*. Wiley-VCH, 1999.
- Schnoor, J.L. (1996), *Environmental Modeling: Fate and Transport of Pollutants in Water, Air and Soil*, John Wiley & Sons, New York, NY.
- W.J. Weber Jr. *Environmental Systems and Processes*. John Wiley & Sons, New York, 2001.

16. Supplementary/recommended readings

1. none

17. Other

1. College of Engineering and Computer Science (COECS) Technology Services Group (TSG)

TSG provides support for students with issues related to the use of College computing resources such as lamp.cse.fau.edu, the student web server, and GENIE, the Citrix Remote Application Server. TSG also supports the Microsoft Developer Network Academic Alliance portal through which students taking courses in CEECS can obtain free copies of many software products from Microsoft. Details of these and other resources are described on the TSG web site at tsg.eng.fau.edu.

For support issues not covered on the web site students must send email to help@eng.fau.edu. TSG responds to help requests only through this email address. Do not attempt to phone them or contact them personally. TSG support is limited to assistance with COECS computing resources such as having your password on lamp reset. They do not handle specific course related questions. Those should be directed to the instructor for the course.

2. FAU Information Resource Management (IRM)

IRM provides support for general computing and network issues at FAU. General information and many resources can be found on the IRM site, www.fau.edu/irm/index.php. IRM provides direct student through an online Help Desk at www.fau.edu/helpdesk/. The help desk includes extensive online support resources and a "Ticket" submission system for support requests. Areas of particular concern to students in this course covered by the Help Desk include general Blackboard, FAU NetId and network login, and FAU Google Email. The Help Desk can also be accessed by phone at (561) 297-3999. Phone access should generally be used only if you are unable to log in to FAU systems. For most other issues the phone consultant will simply record your concern and submit a help ticket on your behalf. The help ticket will get the same treatment as one you submit directly.

3. College of Engineering and Computer Science (COECS) Division of Engineering Student Services (ESS)

ESS provides general advising and academic support for students in COECS including free tutoring support for all students in computer science courses. Additional information can be found on their web page at www.eng.fau.edu/engineering-student-services.

4. FAU University Center for Excellence in Writing (UCEW)

The UCEW, sometimes referred to simply as the Writing Center, provides assistance to students with writing assignments through consultants. They can assess student writing skills and suggest approaches to dealing with problem areas. The center web site is at www.fau.edu/UCEW/WC.

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18. Course topical outline, including dates for exams/quizzes, papers, completion of reading		
Date:	Topic	Reading
Week 1	Introduction	
Week 2	Introduction Definitions - sustainability vs safe yield, Hydrologic cycle, sources, regeneration of supplies, natural systems Water Supply Planning Development of Water Supplies Water Rights, rule-making, water allocation methods permitting, competition for water, existing users	Chapter 1&2
Week 3	Water Supply Availability, Reliability, conservation, supply options, water quality implications, existing uses, potential uses, eco-system impacts Demand Forecasting, planning horizon, planning needs, Water quality considerations, supply limitations	Chapter 3
Week 4	Infrastructure needs, reservoirs, groundwater & wells, ASR Cost of capital, cost of operations, disposal issues Analysis of Alternatives, Benefit Cost analysis Operation of water resources systems Reliability, potential for drought/downtime, contingency planning methods for determining risk, statistical variation	Chapter 4
Week 5	Mass Balance, System characterization, Scales Lakes – Nutrients, Inorganics, Soluble Organic Compounds Limiting nutrients, mass balance, land use, ecosystem impacts	Chapter 5
Week 6	Thermodynamics and Reactivity, Chemical Reactions, Chemical Kinetics (zero, first, second order) Equilibrium Modeling – Precipitation, Reduction, Dissolution	Chapter 6
Week 7	Conventional Pollutants in Rivers - Streeter Phelps, Modifications of Streeter Phelps, Waste Load allocations, Dissolved oxygen, uncertainty <i>Review</i>	
Week 8	Midterm Exam 1	Chapter 7
Week 9	Advective Mass Transport, Dispersive Mass Transport, Diffusive Mass Transport, Fick's Law of Diffusion Advection-Diffusion Equation,	Chapter 9
Week 10	Sediment transport, Lake dispersion calculations, simple transport models, Particle dynamics, Particle suspensions,	Chapter 9
Week 11	Groundwater Contamination – Darcy's Law, flow equations, solute transport, sorption, retardation, transformations <i>Review (Midterm 2 via Blackboard)</i>	
Week 12	Atmospheric deposition – acid deposition, neutralizing, wet and dry deposition, ecological effects, critical loads	Chapter 10
Week 13	Global Atmospheric change (carbon, sulfur and other cycles)	Chapter 10
Week 14	Extension of modeling concepts to natural and engineered systems, Biological Growth Kinetics, Catalysis	Chapter 11

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	Bioconcentration, Bioaccumulation	
Week 15	FINAL PROJECT PRESENTATION <i>Review</i>	
Week 16	FINAL EXAM	

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Assignment Presentation
(Required Format)

All assignments (i.e., homework, projects, etc) to be completed by students attending courses offered by the Civil Engineering Department must be presented in a standardized format.

Any assignments that do not comply with the following guidelines will not be accepted.

1. The assignment must be written in an 8.5 x 11 inches engineering or white paper. The problem narrative must not be repeated in the assignment sheet. However, the problem number from the textbook must be given as well as the GIVEN data and the FIND (whatever the problem is asking for) must be listed briefly. If homework is a handout, attach the handout at the front of the homework.
2. Each page must have:
 - (a) Course Number and Name (e.g., ENV-4514 Environmental Engineering and Science) at the top center,
 - (b) Assignment Number (e.g. HW#5) at the top left,
 - (c) Student's Name (e.g., J.M. Dover) at the top right, and
 - (d) Page Number and Total Number of Pages (e.g. 2/3) at the bottom center.
3. The text and computations in the assignment must be written in a professional manner, i.e.:
 - (a) Any derivations of formulas/equations, symbols, etc must be properly explained,
 - (b) Any assumptions/simplifications made must be mentioned and justified,
 - (c) The solution must be written in reasonable sequence,
 - (d) The final result(s) must be given at the end of the problem written within a box,
 - (e) Half way "solutions" are not acceptable,
 - (f) Just mentioning the solution algorithm/process of the problem is not acceptable; all of the computations must be carried to the very end, and
 - (g) Any unsuccessful initial attempts of solving the problem must be kept out of the assignment submitted.
4. The assignments must be presented also in a legible and well-written manner. The handwriting must be neat otherwise the assignment must be typed.
5. The assignment sheets must not be creased or folded but be stapled together at the upper left corner.

An example of an acceptable HW assignment is attached.

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HW#5 ENV-4514 Environmental Engineering and Science I. Dover

Problem #3.24 (Doe, J.R. "Fundamentals of Environmental Engineering", 1999)

GIVEN: Min value of Oxygen Sag = 3.0 mg/L
Naturally Occurring DO in the stream = 10 mg/L
Min allowable DO = 5.0 mg/L
Reaeration coefficient = 0.80/day
Deoxygenation Coefficient = 0.20/day
Stream velocity = 60 miles/day

FIND: (a) Percentage of BOD that must be treated to ensure healthy environmental conditions
(b) How far downstream in miles the lowest DO would occur?

SOLUTION:

a) The minimum DO of 3.0 mg/L means that the maximum deficit (before fixing it) is

$$DO_{\max} = 10 - 3 = 7 \text{ mg/L}$$

For healthy conditions, the DO_{\min} should be 5 mg/L so that the new DO_{\max} should be

$$DO_{\max(\text{new})} = 10 - 5 = 5 \text{ mg/L}$$

$$\text{Then } DO_{\max} / DO_{\max(\text{new})} = 5.0 / 7.0 = 0.71$$

ANSWER: Thus, 29% of the BOD needs to be removed. Since a primary treatment plant removes about 35% of the BOD (Chapter 3, pp 76) then **it would be enough.**

b) Using Eq. (5.34) the critical time and distance downstream are given as:

$$\text{Critical time: } t_c = \ln(k_r/k_d)/(k_r - k_d) = \ln(0.8/0.2)/(0.8 - 0.2) = 2.31 \text{ days}$$

$$\text{Distance: } L = 60 \text{ mi/day} \times 2.31 \text{ days} = 138.6 \text{ miles}$$

ANSWER: Critical time is **2.31 days**; Distance is **138.6 miles**

Technical/Project Report Writing

(Required Format)

ABSTRACT/EXECUTIVE SUMMARY

Brief but concise description of the project objectives, methodologies, results and conclusions.

TABLE OF CONTENTS

Including List of Figures and List of Tables.

INTRODUCTION/Background

Background information; Description of the existing state-of-the-art; Objectives and goals of the present project; anticipated results.

DESIGN NEEDS/ANALYSIS OF ALTERNATIVES

Detailed description of the (a) current deficiencies (b) Design goals (c) options to achieve design needs (d) materials utilized (e.g., chemicals, type of soils, type of liquids, etc), (e) comparison of alternatives, and (f) summary of alternatives and matrix. Recommend an alternative and why.

DESIGN OF SELECTED OPTION

Data collection, compilation, and analysis using appropriate statistical and/or other analytical tools. Presentation of the analysis results in tabular or graphical formats for easy assimilation.

SUMMARY/CONCLUSIONS/RECOMMENDATION

Very brief description of the project and the conclusions reached.

REFERENCES

List of references cited.

ACKNOWLEDGEMENTS

Give credit to where it belongs.