MIDTERM #2 SAMPLE TEST PROBLEMS

COURSE: DIFFERENTIAL EQUATIONS II (PDEs)
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Disclaimer: This set of sample problems is too long for a final exam. The actual test would be a subset of problems of the general type that appear here. These problems are provided as a study resource, not as a summary of the course taught so far. Problems on the final can come from **any material** in the lectures, tutorials, assignments and pre-reading. These problems however, should give you an idea of the general length you should expect for individual problems. My intention is to make the test a mix of very short problems, like the ones on the midterms, where you can be asked to solve a smallish portion of a larger problem, and longer problems (like the bonus problems) where you have to work through several steps.

The questions below work backwards through the material of the course. You already have considerable study resources in the sample problems posted for midterms 1 and 2 earlier in the term, so I focus here on the material that we covered after the first two midterms. For the problems in Chapter 11, I have indicated how they could be shortened for the final exam. For shorter versions of the problems in Chapter 10, refer to the sample problems for midterms 1 and 2.

For the number of problems on the final exam, you should expect an exam that is roughly 2 1/2 times longer than either of the two midterms. That is, most of you should be able to finish the test within two hours, and have the remaining hour to check over your work.

1. Section 11.5, problems #1-14. (*Note: On the test I would ask you to either determine the condition for existence of solutions **or** give the eigenfunction expansion, not both in the same problem. I might even give you the eigenfunctions of the assocated homogeneous problem and ask you to figure out the eigenfunction expansion from there.*)

2. Section 11.4 #1-6 and #11-16 and #17-26

3. Section 11.4 #27 (*we did this in class.*)

4. Section 11.4 #28

5. Section 11.3 #1-11

6. Section 11.3 #17-24. (*Note: These problems can be shortened by asking either for (1) the eigenfunctions, or (2) the normalised eigenfunctions given the eigenfunctions, or (3) the eigenfunction expansion of $f(x) = x$ (or some other doable function) given the eigenfunctions.*)

7. Section 11.2 #1-20 and #23-26

8. Section 10.7 #1-5 and #7-9 and #11-17

9. Section 10.6 #1-5 and #7-8 and #10

10. Section 10.6 #13-18 (*Note: These are d'Alembert solution problems. You should count on there being one problem of this sort!*)

11. Section 10.5 #1-18

12. Section 10.4 #1-19

13. Section 10.3 #9-16 (without the computer plotting part) and #17-24

14. Section 10.2 #1-24

15. Find the general solution of the PDE

$$3\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + 5u = \sin(xy).$$

(*Note: This is a method of characteristics problem. You should expect one problem of this sort.*)