Rev 5-79

(2)

FACULTY SENATE CURRICULUM COMMITTEE

APPROVAL FORM

1) An approval Form must accompany each proposal.

2) A proposed catalogue description of the course must accompany the proposal as a separate page.

3) Results of all consultations must be attached to the proposal.

Proposal Title COURSE PROPOSAL: ELECTRIC CIRCUITS

Sponsor(s) LAWRENCE DELANEY Dept. PHYSICAL SCIENCES

Check One: Course ✓ Credit/Level/Title Change or deletion ____ Other ____

Concentration ____ Specialization ____ Major Program ____ Certification ____

Graduate ____ Undergraduate ✓ No. of Credits 4

REVIEWS

Department Curr. Comm.	Division Curr. Comm	Dean of Division
Reviewed AUGUST 23, 1981 (Date)	Reviewed Oct 9?, 81 (Date)	Reviewed [illegible] (Date)
Approved ~~Not Approved~~ AUGUST 23, 1981 (Date)	Approved Not Approved ____ (Date)	
Laurence Delaney — Chairperson Dept. Curr. Comm.	[signature] — Chairperson Div. Curr Comm.	[signature] — Signature
[signature] — Department Chairperson		

SENATE CURRICULUM COMMITTEE

SCC # 81-82-3 Proposal Received 10/14/81 Open Hearing Held 11/20/81

Returned to the department for the following reason(s):

Approved by the Curriculum Committee: Date 11/20/81

Presented to ~~Executive Committee of the~~ Faculty Senate as information: Date 12/11/81

Notifications forwarded: Vice President for Academic Affairs: Date ____

Shirley A. O'Day

Signature: Chairperson, Senate Curriculum Committee

VICE PRESIDENT FOR ACADEMIC AFFAIRS

Official copy and approval sheet filled ____________ ____________________
Date Signature

Course approved Yes ✓ No ______

If no, reasons are as follows:

1.
2.
3.

Student credit hours assigned 3

Faculty load hours ______

Equalized credit hours ______

REGISTRAR

Approved course description received and Hegis Taxonomy Number assigned
by Registrar Yes ______ No ______

Hegis Taxonomy Number [illegible]

______________________________ ______________________
Signature: Registrar Date

ACADEMIC DEAN

Yes Budget, faculty library allocations and Academic Support Services are adequate for immediate implementation.

No Constraints do not permit implementation. The earliest the proposal might be implemented would be ______________

______________________________ ______________________
Signature: Academic Dean Date

Copies forwarded: Senate Curriculum Committee Chairperson, Department Chairperson, Registrar

State of New Jersey

GLASSBORO STATE COLLEGE
GLASSBORO, NEW JERSEY 08028

Memorandum

December 4, 1981

To: Mr. Bryant Kelsey, Assistant Registrar

FROM: L. Delaney, Dept. of Physical Sciences

SUBJ: Hegis Number assignment

1. The course Electric Circuits was recently approved by the Curriculum Committee of the Faculty Senate

2. I would like to suggest that the Hegis Number 1902.399 be assigned to this course when it is fully approved.

L.D.

G L A S S B O R O   S T A T E   C O L L E G E

TO: Senate Curriculum Committee

FROM: Curriculum Committee, Department of Physical Sciences

SUBJECT: Course Proposal: Electric Circuits

I. Sponsor

The Curriculum Committee of the Department of Physical Sciences sponsors this proposal. The chairman of this committee, Lawrence Delaney, is to be considered the initiator and administrator.

II. The Proposal

It is proposed that a 4 S.H. undergraduate course entitled, Electric Circuits, be approved as an offering of the Department of Physical Sciences. The prerequisites would be Calculus II and Physics II.

Pre-engineering students would take either the proposed course or Analytical Mechanics in the spring semester of the sophomore year, depending on which is offered at the time. The first offering of Electric Circuits is planned for the spring of 1983. Subsequent offerings would be scheduled for the springs of odd numbered years, alternating with Analytical Mechanics, which is scheduled for the springs of even numbered years. These two courses correspond to Electrical Engineering I and Statics, respectively, which are required in all of the undergraduate engineering programs offered by Drexel University.

For students pursuing the Physical Science major, the proposed course would serve as an advanced elective course, and would be taken in the spring semester of the junior or senior year.

III. Details of the Proposal

The staff, equipment, lab facilities and literature resources needed to teach this course in alternate years, are on hand. It is anticipated that college and departmental financing will be sufficient to provide the new equipment needed as laboratory experiments are revised and replaced.

As indicated by the prerequisites, the course would be a mathematical treatment of electric circuits, and would be a logical extension of the treatment of electricity begun in Physics II. Emphasis would be on the mathematical methods of analyzing the behavior of single phase and polyphase circuits. A large percentage of class and assignment time would be used in solving problems. Circuits of the type discussed in class presentations would be built and tested in the laboratory.

The purpose of the course would not be to develop familiarity with electronic technology, but rather to provide the prospective engineer or scientist with the analytic understanding of circuit theory and techniques needed for effective study, at the engineering level, of electronic instruments and systems as well as electric power generation, transmission and utilization.

III. Details of the Proposal (continued)

The text for the course would be Engineering Circuit Analysis, third edition; Hoyt and Kemmerly; McGraw-Hill. Student progress would be evaluated through problem tests, laboratory reports and homework assignments.

IV. Topics

1. Charge, current, voltage, power
2. Circuit elements.
3. Ohm's law, Kirchhoff's laws
4. Single loop and single node-pair circuits
5. Voltage and current division
6. Nodal and mesh analysis
7. Source transformations
8. Linerarity and superposition
9. Trees, general nodal analysis, links and loop analysis
10. Inductor and capacitor
11. Inductance - capacitance combinations
12. Duality and linearity
13. RL, RC, and RLC circuitry
14. Exponent _ response
15. Unit step forcing function
16. Natural and forced response
17. Source free circuits
18. Overdamped, critically damped and underdamped RLC circuits
19. Characteristics of sinusoids
20. Forced response to sinusoidal forcing functions
21. Complex forcing function
22. Phasors
23. Impedance and admittance
24. A.C. nodal, mesh and loop analysis
25. A.C. superposition, source transformations and Thevenin's theorem
26. Frequency reponse
27. A. C. power
28. Single phase three-wire systems
29. Three phase Y-Y and Delta connections
30. Power measurement in three phase systems
31. Computerized circuit simulations and solutions

V. Rationale

Scientists and engineers of all persuasions work with increasingly complex electrical communication, control, computer, measurement and power systems. Since the electric circuit is the foundation upon which all such systems are built, an analytic understanding of electric circuits is increasingly needed. This fact is recognized at Drexel University where a circuit analysis course is a requirement in all undergraduate engineering programs.

The proposed course is designed to correspond to the above circuit analysis requirement, and is presently being evaluated for transfer credit to all engineering programs at Drexel. If approved, it will become part of a new pre-engineering transfer agreement with Drexel.

Glassboro's present pre-engineering program, which has been in operation since 1976, is based upon an agreement developed cooperatively by representatives of Glassboro and Drexel for the purpose of awarding up to four semesters of transfer credit to Glassboro students intending to transfer to an engineering curriculum at Drexel University Evening College. This program is limited in that it:

(1) applies only to Drexel Evening College, and

(2) includes only eight math-science courses:
Calculus I, II, III, Differential Equations,
Physics I, II and Chemistry I, II

Because of these limitations, and because of the changes which have occurred in the curricula at both institutions, a new pre-engineering program has been proposed and is now being evaluated by Drexel. This new program would apply to both day and evening divisions at Drexel and would include additional mathematics, science and liberal studies courses. The proposed course, Electric Circuits, is among these courses and is the only course in the new program which is not an approved Glassboro offering. This proposal seeks its approval.

VI. Results of Consultations

The chairman of the Department of Industrial Education and Technology, Paul Von Holtz, was consulted. His reaction was favorable but he suggested that Michael Guerard of his department also be consulted. Dr. Guerard saw no conflict between his department's offerings in the area of electricity and the proposed course (please see his written statement, attached).

Professor Cogan of the Department of Electrical Engineering at Drexel University has been consulted and has been most kind in supplying the information, encouragement and advice needed to plan this course.

Proposed Catalog Description for "Electric Circuits"

1902.3-- 4 S.H.

Electric Circuits (Lecture and lab)

(Prerequisites: 1701.131 and 1902.201 or 1902.203)

An analytic study of electric circuit theory and methods of single phase and polyphase circuit analysis. Intended for Pre-engineering and Physical Science majors. Problem work is emphasized.

GLASSBORO STATE COLLEGE
GLASSBORO, NEW JERSEY 08028

September 2, 1981

Dr. Lawrence Delaney
Physical Sciences
Bosshart
Glassboro State College
Glassboro, NJ 08028

Dear Larry:

I am pleased to offer my support for your proposed course, Electric Circuits, as a course for the Drexel engineering transfer program.

The prerequisites you specify make it clear that the course content and depth of coverage would be beyond that which we would consider in our own area. The purpose of your course (engineering fundamentals) is clearly different from our own courses in electricity/electronics (secondary level subject matter); I see no conflict whatsoever. Please let me know if I can be of any further assistance.

Sincerely,

Michael P. Guerard
Associate Professor

MPG/jlh

Course Objectives - Electric Circuits

The student should be able to:

1. Define and state MKS units for: charge, current, voltage, power, energy.

2. Write the current-voltage and voltage-current relationships for resistors and capacitors and inductors.

3. Given a voltage or current waveform, predict the waveform of the response if the given wave is impressed on a resistor, inductor or capacitor.

4. Derive from the voltage-current relationships, the energy dissipated in a resistor and the energy stored in a capacitor or in an inductor in terms of voltage or current. Calculate the power or energy associated with R, L or C in a circuit.

5. State the rules governing the abrupt change of current for an inductor or the abrupt change of voltage for a capacitor, in the absence of impulses (continuity of stored energy).

6. Sketch the symbol and define ideal current source and ideal voltage source.

7. State Kirchhoff's current and voltage laws and use the laws to obtain an equation from any close path or any node in a network.

8. Use the loop current method and/or the node voltage method to obtain simultaneous equations for resistive networks and solve them using determinants.

9. Reduce series or parallel connections of like elements to a single equivalent.

10. Apply the concept of "voltage divider" or "current divider" to solve appropriate circuits without using loop or node equations.

11. State Thevenin's and Norton's Theorems and replace any one-port network by either the Thevenin's or Norton's equivalent circuit.

12. State the Superposition Theorem and apply the theorem to any network containing more than one source.

13. Given the mathematical expression for an exponential decay function:
    a. sketch the graph of the function vs. time.
    b. label the initial and final values.
    c. evaluate the time constant.

14. Given the graph of an exponential function:
    a. write a mathematical expression for it.
    b. compute the time constant.

15. Given the mathematical expression for a sinusoid:
    a. sketch the graph of the function vs. time.
    b. label the ordinate and/or abscissa value for all axis crossings.
    c. evaluate the maximum value, period, frequency and phase angle.

Course Objectives (continued)

16. Given the graph of a sinusoidal function you should be able to:
    a. write a mathematical expression for it either in terms of sine or cosine.
    b. evaluate the amplitude, period, frequency and phase angle.

17. Perform algebraic operations with complex numbers including:
    a. conversion from polar to rectangular form and back.
    b. addition, subtraction, multiplication and division, and finding powers and roots of complex numbers.

18. Given sinusoidal functions of time,
    a. write the phasor that represents it.
    b. sketch its phasor representation on the complex plane.
    c. using phasors and complex algebra add or subtract sinusoids of the same frequency but different phase angles and write the answer as a function of time as well as sketching it on a phasor diagram.

19. Given any periodic wave, calculate its average and effective values.

20. Determine and solve the equation(s) which describe first order systems with no driving force applied. Predict the form of the solution by inspection of the equation.

21. Do the same for second order systems with no driving force although the prediction of the form of the solution may require a simple calculation

22. Determine the impedance as a function of s for any 1 port made up of R, L and C elements. Sketch the poles and zeros of the impedance and determine the form of the natural response from them.

23. Compute the forced response of any circuit of R's, L's and C's to forcing functions of the form Ae^{st} where s may be zero, a negative real number or a pure imaginary number.

24. Calculate the complex impedance or admittance of any network subject to sinusoidal steady driving forces and use phasors and complex algebra to determine magnitude and phase angle of the response of a network to sinusoidal steady state signals.

25. Predict conditions in switched circuits at $t=0^+$ (just after switching).

26. Solve for the response of any first or second order circuit driven by a function Ae^{st} where s may be negative real, zero or pure imaginary.

27. Define and write a mathematical expression for instantaneous power, p, average power, P, reactive power, Px, and power factor, pf. Express each in proper units.

28. Compute all values of both the "impedance triangle" and the "power triangle" for any load driven by a sinusoidal source. Determine the complex value called "apparent power", Pa.

Course Objectives (continued)

29. Determine the reactive element necessary to bring the power factor of a given load into specifications.

30. Write definitions and/or mathematical expressions to describe the following: resonance, resonant frequency, quality factor, selectivity, half power frequency, bandwidth.

31. Calculate resonant frequency, bandwidth, half power frequencies, and Q for any circuit having such properties.

32. Given a 3 phase balanced Y or Δ source and load, determine all currents and voltages.

33. Define "equivalence" of networks and test given networks for equivalence.

34. Define linearity as applied to networks. Identify linear and non-linear networks by inspection.

35. State Therenin's and Norton's theorems and replace any linear active two port by its Therenin or Norton equivalent.

36. State and prove the maximum power transfer theorem as it applies to steady state sinusoidal cases. Find the proper load to achieve maximum power transfer from any two port. Find the value of the maximum power available from any two port.

37. State the reciprocity theorem and apply it to any two port.

38. Make T - π (also called Y - Δ) transformations and vice versa.

39. Write from memory all 6 sets of two port parameter equations.

40. Given a two port network, determine any set of parameters.

41. Convert from any set of two port parameters to any other set.

42. Replace any 2 port by an equivalent circuit of Y or Z parameters.

43. Construct circuits of the types studied and perform tests on these circuits to verify the theoretical conditions.

44. Perform simulated experiments and circuit analyses with the aid of computer programs.