| | Universitas Negeri Surabaya<br>Faculty of Engineering,<br>Electrical Engineering Undergraduate Study Program | Document Code |
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# SEMESTER LEARNING PLAN

| Courses | CODE | Course Family | Credit Weight | | | SEMESTER | Compilation Date |
|---|---|---|---|---|---|---|---|
| Engineering Mathematics I | 2020103076 | Compulsory Study Program Subjects | T=3 | P=0 | ECTS=4.77 | 2 | July 18, 2024 |

| AUTHORIZATION | SP Developer | Course Cluster Coordinator | Study Program Coordinator |
|---|---|---|---|
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| **Learning model** | **Case Studies** |

**Program Learning Outcomes (PLO)**

**PLO study program that is charged to the course**

**Program Objectives (PO)**

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| **PO - 1** | Able to define and classify Differential Equation models |
| **PO - 2** | Able to solve first order differential equations using direct integration method, separation of variables, substitution y=vx, linear PD with integration factor, PD Bernoulli, PD Exact Inexact |
| **PO - 3** | Able to use PD analysis to determine orthogonal functions |
| **PO - 4** | Be able to explain second order, special types of second order (Euler-Cauchy and Legendre) in terms of homogeneous linear differential equations with constant coefficients |
| **PO - 5** | Able to solve n-order Homogeneous Linear PD, Cauchy-Euler PD, Non-Homogeneous Linear PD |
| **PO - 6** | Able to apply the PD model to harmonic motion systems |

**PLO-PO Matrix**

| P.O |
|---|
| PO-1 |
| PO-2 |
| PO-3 |
| PO-4 |
| PO-5 |
| PO-6 |

**PO Matrix at the end of each learning stage (Sub-PO)**

| P.O | Week | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| PO-1 | | | | | | | | | | | | | | | | |
| PO-2 | | | | | | | | | | | | | | | | |
| PO-3 | | | | | | | | | | | | | | | | |
| PO-4 | | | | | | | | | | | | | | | | |
| PO-5 | | | | | | | | | | | | | | | | |
| PO-6 | | | | | | | | | | | | | | | | |

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| **Short Course Description** | Through this lecture, students can explain First Degree First Order PD: Formation of PD, Separation of Variables, Homogeneous, Linear, Exact and Inexact; First Degree First Order PD Applications: Trajectories and Electrical Circuits; Homogeneous Linear PD with Constant Coefficients: Second Order, nth Order, Second Order Special Type (Euler-Cauchy and Legendre); Non-Homogeneous Linear PD with Constant Coefficients: Undetermined Coefficients, Inversion Operators, Parameter Variation, Simultaneous Linear PD; First Degree Second Order PD Applications: Oscillations and Electrical Circuits; |
| **References** | **Main :**<br>1. Purcell, E.J. dan Verberg. 1999. Kalkulus dan Geometri Analitik 1. Terjemahan I.N Susila, B Kartasasmita dan Rawuh. Jakarta: Erlangga.<br>**Supporters:**<br>1. Thomas & Finney, 1988. Calculus dan Analityc Geometry. USA: Addition 7th – Wisley Publishing Company, Inc<br>2. Stround, K.A. dan Erwin Sucipto. 1995. Matematika untuk Teknik. Jakarta: Erlangga |
| **Supporting lecturer** | Prof. Dr. Ismet Basuki, M.Pd.<br>Endryansyah, S.T., M.T.<br>Dr. Raden Roro Hapsari Peni Agustin Tjahyaningtijas, S.Si., M.T.<br>Dr. Lusia Rakhmawati, S.T., M.T.<br>Dr. Farid Baskoro, S.T., M.T.<br>Miftahur Rohman, S.T., M.T.<br>Rifqi Firmansyah, S.T., M.T.<br>Sayyidul Aulia Alamsyah, S.T., M.T. |

| Week- | Final abilities of each learning stage (Sub-PO) | Evaluation | | Help Learning, Learning methods, Student Assignments, [ Estimated time] | | Learning materials [ References ] | Assessment Weight (%) |
|---|---|---|---|---|---|---|---|
| | | Indicator | Criteria & Form | Offline ( *offline* ) | Online ( *online* ) | | |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| 1 | Able to define and classify Differential Equation models | 1.Able to explain the definition of differential equations<br>2.Able to classify differential equations | **Criteria:** The evaluation rubric uses the analytical method (the process of giving grades based on analysis that is adjusted to the answers provided based on the level of truth)<br><br>**Form of Assessment** : Participatory Activities, Tests | Through lectures, questions and answers and 3 X 50 assignments | | **Material:** Basic Concepts of Differential Equations **Library:** *Stround, KA and Erwin Sucipto. 1995. Mathematics for Engineering. Jakarta: Erlangga* | 3% |
| 2 | Able to define and classify Differential Equation models | 1.Able to explain the forms of solutions to differential equations<br>2.Able to explain the formation of differential equations | **Criteria:** The evaluation rubric uses the analytical method (the process of giving grades based on analysis that is adjusted to the answers provided based on the level of truth)<br><br>**Form of Assessment** : Participatory Activities, Tests | Through lectures, questions and answers and 3 X 50 assignments | | **Material:** Basic Concepts of Differential Equations **Library:** *Stround, KA and Erwin Sucipto. 1995. Mathematics for Engineering. Jakarta: Erlangga* | 3% |
| 3 | Able to solve first order differential equations using direct integration methods, separation of variables, substitution y=vx, linear PD with integration factors, Bernoulli PD, Exact Tak Exact PD and using the Matlab program | 1.Able to complete PD order 1 with direct integration<br>2.Able to complete 1st order PD with variable separation<br>3.Able to complete 1st Order Homogeneous Linear PD | **Criteria:** The evaluation rubric uses the analytical method (the process of giving grades based on analysis that is adjusted to the answers provided based on the level of truth)<br><br>**Form of Assessment** : Participatory Activities, Tests | Through lectures, questions and answers and 3 X 50 assignments | | **Material:** First Order Ordinary Differential Equations **References:** *Stround, KA and Erwin Sucipto. 1995. Mathematics for Engineering. Jakarta: Erlangga* | 5% |

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| **4** | Able to solve first order differential equations using direct integration methods, separation of variables, substitution y=vx, linear PD with integration factors, Bernoulli PD, Exact Tak Exact PD and using the Matlab program | 1. Able to solve Bernoulli's equation<br>2. Able to complete Exact and Inexact PD | **Criteria:**<br>The evaluation rubric uses the analytical method (the process of giving grades based on analysis that is adjusted to the answers provided based on the level of truth)<br><br>**Form of Assessment** : Participatory Activities, Tests | Through lectures, questions and answers and 3 X 50 assignments | | **Material:** First Order Ordinary Differential Equations<br>**References:** *Stround, KA and Erwin Sucipto. 1995. Mathematics for Engineering. Jakarta: Erlangga* | 3% |
| **5** | Able to use PD analysis to determine orthogonal functions | Able to complete orthogonal trajectories | **Criteria:**<br>The evaluation rubric uses the analytical method (the process of giving grades based on analysis that is adjusted to the answers provided based on the level of truth)<br><br>**Form of Assessment** : Participatory Activities, Tests | Through lectures, questions and answers and 3 X 50 assignments | | **Material:** Application of first order GDP<br>**References:** *Stround, KA and Erwin Sucipto. 1995. Mathematics for Engineering. Jakarta: Erlangga* | 3% |
| **6** | Able to create orthogoal trajectory graphs using the Matlab program | Able to use Matlab to create orthogonal trajectory graphs | **Criteria:**<br>The evaluation rubric uses the analytical method (the process of giving grades based on analysis that is adjusted to the answers provided based on the level of truth)<br><br>**Form of Assessment** : Participatory Activities, Tests | Through lectures, questions and answers and 3 X 50 assignments | | **Material:** Application of first order GDP<br>**References:** *Stround, KA and Erwin Sucipto. 1995. Mathematics for Engineering. Jakarta: Erlangga* | 5% |
| **7** | Able to create and complete PD models for RC and RL series circuits | 1. Able to create PD models on RL and RC series circuits<br>2. Able to complete PD models on RL and RC series circuits | **Criteria:**<br>The evaluation rubric uses the analytical method (the process of giving grades based on analysis that is adjusted to the answers provided based on the level of truth)<br><br>**Form of Assessment** : Participatory Activities, Tests | Through lectures, questions and answers and 3 X 50 assignments | | **Material:** Application of first order GDP<br>**References:** *Stround, KA and Erwin Sucipto. 1995. Mathematics for Engineering. Jakarta: Erlangga* | 3% |
| **8** | UTS | Accuracy in completing the questions provided in the time provided | **Criteria:**<br>Each question item has an assessment weight adjusted to the student's ability to answer<br><br>**Form of Assessment** : Participatory Activities, Tests | Midterm Exam 3 X 50 | | | 20% |
| **9** | Able to solve n-order Homogeneous Linear PD, Cauchy-Euler PD | Able to explain the concept of linear PD | **Criteria:**<br>The evaluation rubric uses the analytical method (the process of giving grades based on analysis that is adjusted to the answers provided based on the level of truth)<br><br>**Form of Assessment** : Participatory Activities, Tests | Through lectures, questions and answers and 3 X 50 assignments | | **Material:** Linear Differential Equations<br>**Library:** *Stround, KA and Erwin Sucipto. 1995. Mathematics for Engineering. Jakarta: Erlangga* | 5% |

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| **10** | Able to solve n-order Homogeneous Linear PD, Cauchy-Euler PD | 1. Able to explain the concepts of linear independence, Wronski determinant and super position<br>2. Able to explain the method for solving Homogeneous PD order 2 | **Criteria:** The evaluation rubric uses the analytical method (the process of giving grades based on analysis that is adjusted to the answers provided based on the level of truth)<br><br>**Form of Assessment** : Participatory Activities, Tests | Through lectures, questions and answers and 3 X 50 assignments | | **Material:** Linear Differential Equations **Library:** *Stround, KA and Erwin Sucipto. 1995. Mathematics for Engineering. Jakarta: Erlangga* | 3% |
| **11** | Able to solve Non-Homogeneous Linear PD | Be able to explain the method for solving inhomogeneous PD | **Criteria:** The evaluation rubric uses the analytical method (the process of giving grades based on analysis that is adjusted to the answers provided based on the level of truth)<br><br>**Form of Assessment** : Participatory Activities, Tests | Through lectures, questions and answers and 3 X 50 assignments | | **Material:** Linear Differential Equations **Library:** *Stround, KA and Erwin Sucipto. 1995. Mathematics for Engineering. Jakarta: Erlangga* | 3% |
| **12** | Able to create PD models for harmonic motion systems | 1. Able to create PD models on motion systems<br>2. Able to explain the classification of movement systems | **Criteria:** The evaluation rubric uses the analytical method (the process of giving grades based on analysis that is adjusted to the answers provided based on the level of truth)<br><br>**Form of Assessment** : Participatory Activities, Tests | Through lectures, questions and answers and 3 X 50 assignments | | **Material:** Second level PD application **Reader:** *Stround, KA and Erwin Sucipto. 1995. Mathematics for Engineering. Jakarta: Erlangga* | 5% |
| **13** | Able to complete Undamped, Underdamped, Overdamped and Critically damped motion system models | 1. Able to explain models of undamped, underdamped, overdamped and critically damped motion systems<br>2. Able to complete undamped, underdamped, overdamped and critically damped motion system models | **Criteria:** The evaluation rubric uses the analytical method (the process of giving grades based on analysis that is adjusted to the answers provided based on the level of truth)<br><br>**Form of Assessment** : Participatory Activities, Tests | Through lectures, questions and answers and 3 X 50 assignments | | **Material:** Second level PD application **Reader:** *Stround, KA and Erwin Sucipto. 1995. Mathematics for Engineering. Jakarta: Erlangga* | 3% |
| **14** | Able to create and complete PD models for RLC series | 1. Able to create PD models on movement system classification<br>2. Able to complete PD on movement system classification | **Criteria:** The evaluation rubric uses the analytical method (the process of giving grades based on analysis that is adjusted to the answers provided based on the level of truth)<br><br>**Form of Assessment** : Participatory Activities, Tests | Through lectures, questions and answers and 3 X 50 assignments | | **Material:** Second level PD application **Reader:** *Stround, KA and Erwin Sucipto. 1995. Mathematics for Engineering. Jakarta: Erlangga* | 3% |

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| **15** | Able to create a series PD RLC model response program with the Matlab program | 1. Able to create models of series LC and RLC electrical circuits using Matlab<br>2. Able to complete PD on series LC and RLC electrical circuits using Matlab | **Criteria:** The evaluation rubric uses the analytical method (the process of giving grades based on analysis that is adjusted to the answers provided based on the level of truth)<br><br>**Form of Assessment** : Participatory Activities, Tests | Through lectures, questions and answers and 3 X 50 assignments | | **Material:** Second level PD application<br>**Reader:** *Stround, KA and Erwin Sucipto. 1995. Mathematics for Engineering. Jakarta: Erlangga* | 3% |
| **16** | UAS | Accuracy in completing the questions provided in the time provided | **Criteria:** Each question item has an assessment weight adjusted to the student's ability to answer<br><br>**Form of Assessment** : Participatory Activities, Tests | 3 X 50 Semester Final Exam | | | 30% |

**Evaluation Percentage Recap: Case Study**

| No | Evaluation | Percentage |
|---|---|---|
| 1. | Participatory Activities | 50% |
| 2. | Test | 50% |
| | | 100% |

**Notes**

1. **Learning Outcomes of Study Program Graduates (PLO - Study Program)** are the abilities possessed by each Study Program graduate which are the internalization of attitudes, mastery of knowledge and skills according to the level of their study program obtained through the learning process.
2. **The PLO imposed on courses** are several learning outcomes of study program graduates (CPL-Study Program) which are used for the formation/development of a course consisting of aspects of attitude, general skills, special skills and knowledge.
3. **Program Objectives (PO)** are abilities that are specifically described from the PLO assigned to a course, and are specific to the study material or learning materials for that course.
4. **Subject Sub-PO (Sub-PO)** is a capability that is specifically described from the PO that can be measured or observed and is the final ability that is planned at each learning stage, and is specific to the learning material of the course.
5. **Indicators for assessing** ability in the process and student learning outcomes are specific and measurable statements that identify the ability or performance of student learning outcomes accompanied by evidence.
6. **Assessment Criteria** are benchmarks used as a measure or measure of learning achievement in assessments based on predetermined indicators. Assessment criteria are guidelines for assessors so that assessments are consistent and unbiased. Criteria can be quantitative or qualitative.
7. **Forms of assessment:** test and non-test.
8. **Forms of learning:** Lecture, Response, Tutorial, Seminar or equivalent, Practicum, Studio Practice, Workshop Practice, Field Practice, Research, Community Service and/or other equivalent forms of learning.
9. **Learning Methods:** Small Group Discussion, Role-Play & Simulation, Discovery Learning, Self-Directed Learning, Cooperative Learning, Collaborative Learning, Contextual Learning, Project Based Learning, and other equivalent methods.
10. **Learning materials** are details or descriptions of study materials which can be presented in the form of several main points and sub-topics.
11. **The assessment weight** is the percentage of assessment of each sub-PO achievement whose size is proportional to the level of difficulty of achieving that sub-PO, and the total is 100%.
12. TM=Face to face, PT=Structured assignments, BM=Independent study.