TEACHING INSTRUCTIONAL DESIGN (BRP)

COURSE

MATHEMATICAL METHODS IN PHYSICS 2

by

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PREFACE

The Learning Design Book or abbreviated as BRP contains lesson plans for one semester. BRP was prepared to be used as a reference for learning the Mathematical Methods in Physics 2 course at Physics Departement Faculty of Mathematics and Natural Sciences.

Mathematical Methods in Physics 2 course is scheduled to be followed by all 3rd semester physics students as a basic physics course that must be mastered to take the next courses , as Mathematical Methods in Physics 3 and Energy Physics. In those semester students are required to take Mathematical Methods in Physics 1 course.

Mathematical Methods in Physics 2 course, students students will study mathematical methods in the form of the Fourier series, integral transform calculus of variations, and complex analysis and apply them to physics problems.

With the arrangement of this BRP, it is hoped that it can become a reference for the learning process for lecturers and for students participating in lectures and for people who want to learn it.

Depok, Mei 2017

Ttd

Dr. Budhy Kurniawan
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I. General Inforamation

1.	Name of Program / Study Level	:	Physics / Undergraduate
2.	Course Name	:	Mathematical Methods in Physics 2
3.	Course Code	:	SCFI602215
4.	Semester	:	3
5.	Credits	:	4 Credits
6.	Teaching Method(s)	:	Cooperative & Self-Direct Learning
7.	Prerequisite course(s)	:	Matematika Dasar 2, Mathematical Methods in Physics 1
8.	Requisite for course(s)	:	Mathematical Methods in Physics 3, Mechanical Classic
9.	Integration Between Other Course	:	-
10.	Lecture(s)	:	1. Dr. Budhy Kurniawan 2. Dr. Vivi Fauzia, M.Si
11.	Course Description	:	Mathematical Methods in Physics 2 course, students learn about mathematical methods consisting Fourier series, integral transformations, calculus of variations, and complex analysis and apply them to physics problems

II. Course Learning Outcome (CLO) and Sub-CLOs

A. CLO

After this course, students are able to apply mathematical methods in the form Fourier series Setelah menyelesaikan modul ini, mahasiswadiharapkan mampu menerapkanmetode matematika berupa deret Fourier, integral transformations, calculus of variations,and complex analysis in basic physics problems. (ELO 1,2,6)

B. Sub-CLOs

1. To explain the concept of Fourier Series (C2)
2. To calculate Menghitung fungsi periodik, deret Fourier kompleks dan teorema Parseval (C3)
3. To apply the concept of Fourier Series in solving physics problems (C3)
4. To explain the concept of variations of calculus (C2)
5. To calculate using principles variation of calculus and Euler equation (C3)
6. To apply the concept of variation of calculus in solving physics problems (C3)
7. To explain the concept of complex analysis (C2)
8. To calculate complex algebra, Caunchy Integral, Laurent Series and Residu Theorm (C3)
9. To apply the concept complex analysis in solving physics problems (C3)
10. To explain the concept of Integral Transforms (C2)
11. To calculate Laplace Theorm, Fourier Series, Delta Dirac Function and Convolution Integral (C3)
12. To apply the concept of Integral Transform in solving physics problems (C3)

III. Teaching Plan

Week	Sub-CLO	Study Material	Teaching Method	Time Required	Learning Experiences (*O-E-F)	Sub-CLO Weight on Course (%)	Sub-CLO Achievement Indicator	Reference
1	1	Fourier Series	Cooperative &Self-Directed Learning	200 minutes	O : Introduction(30%) E : Individual and Group Assignment (40%) F :Plenary & Feedback (30%)	6	Explain the concept of Fourier Series	No.3 Page 935-949
2	2	Fourier Series	Cooperative &Self-Directed Learning	200 minutes	O : Introduction(30%) E : Individual and Group Assignment (40%) F :Plenary & Feedback (30%)	6	Calculate periodic function complex Fourier Series and Parseval theorm	No.3 Page 950-957
3	3	Fourier Series	Cooperative &Self-Directed Learning	200 minutes	O : Introduction(30%) E : Individual and Group Assignment (40%) F :Plenary & Feedback (30%)	6	Apply the concept of Fourier Series in solving problems physics	No.3 Page 958-962
4	4	Calculus Variation	Cooperative &Self-Directed Learning	200 minutes	O : Introduction(30%) E : Individual and Group Assignment (40%) F :Plenary & Feedback (30%)	6	Explain the concept of variation calculus	No.3 Page 1081-1096
5	5	Calculus Variation	Cooperative &Self-Directed Learning	200 minutes	O : Introduction(30%) E : Individual and Group Assignment (40%) F :Plenary & Feedback (30%)	6	Calculate variation principle	No.3 Page 1096-1106
6	5	Calculus Variation	Cooperative &Self-Directed Learning	200 minutes	O : Introduction(30%) E : Individual and Group Assignment (40%) F :Plenary & Feedback (30%)	6	Calculate Euler equation	No.3 Page 1107-1110
7	6	Calculus Variation	Cooperative &Self-Directed Learning	200 minutes	O : Introduction(30%) E : Individual and Group Assignment (40%) F :Plenary & Feedback	7	Apply the concept of variation calculus in solving problems physics	No.3 Page 1111-1124

					(30%)(30%)			
8	**Mid Term Exam**							
9	7	Complex Analysis	Cooperative &Self-Directed Learning	200 minutes	O : Introduction(30%) E : Individual and Group Assignment (40%) F :Plenary & Feedback (30%)	6	Explain the concept of Complex Analysis	No.3 Page 469-470
10	8	Complex Analysis	Cooperative &Self-Directed Learning	200 minutes	O : Introduction(30%) E : Individual and Group Assignment (40%) F :Plenary & Feedback (30%)	8	Calculate complex algebra and Integral Caunchy	No.3 Page 471-486
11	8	Complex Analysis	Cooperative &Self-Directed Learning	200 minutes	O : Introduction(30%) E : Individual and Group Assignment (40%) F :Plenary & Feedback (30%)	8	Calculate Laurent Series and Residu Theorm	No.3 Page 487-509
12	9	Complex Analysis	Cooperative &Self-Directed Learning	200 minutes	O : Introduction(30%) E : Individual and Group Assignment (40%) F :Plenary & Feedback (30%)	7	Apply the concept of complex analysis in solving problems physics	No.3 Page 510-598
13	10	Integral Transform	Cooperative &Self-Directed Learning	200 minutes	O : Introduction(30%) E : Individual and Group Assignment (40%) F :Plenary & Feedback (30%)	10	Explain the concept of Integral Transform	No.3 Page 963-966
14	11	Integral Transform	Cooperative &Self-Directed Learning	200 minutes	O : Introduction(30%) E : Individual and Group Assignment (40%) F :Plenary & Feedback (30%)	10	Calculate Laplace Theorm, Fourier Transform, Delta Dirac Function dan Integral Convolution	No.3 Page 967-1034
15	12	Integral Transform	Cooperative &Self-Directed Learning	200 minutes	O : Introduction(30%) E : Individual and Group Assignment (40%) F :Plenary & Feedback (30%)	8	Students are able to apply potential calculation methods to magnetic materials	No. 3 Page 1035-1046
16	**Final Exam**							

*) O : Orientation
E : Exercise
F : Feed Back

References:

1. M.L. Boas, Mathematical Methods in The Physical Sciences 3rd ed, John Wiley & Sons, 1983
2. B.D. Gupta, Mathematical Physics, Vikas Publishing, 1993
3. G.B. Arfken and H.J. Weber, Mathematical Methods for Physicists, Academic Press, 1995
4. L.A. Pipes and L.R. Harvill, Applied Mathematics for Engineers and Physicist, McGraw Hill,1970.

IV. Assignment Design and Exercise

Week	Assignment Name	Sub-CLOs	Assignment	Scope	Working Procedur	Deadline	Outcome
1-3	Individual assignment	1, 2, 3	Problem set	a. Periodic function, Complex Fourier Series, Dirichlet Condition and Parseval theorm. b. Fourier Series Application.	In class / Group, Independent and Online	100 minutes	*Lecture Power point,,*individual and group assignment sheet
4-7	Individual assignment	4,5, 6	Problem set	a. Variation principle, Euler's equation with multiple variables b. Variation calculus application	In class / Group, Independent and Online	100 minutes	*Lecture Power point,,*individual and group assignment sheet
8	Mid Term Exam						
9-12	Group assignment	7,8,9	Problem set	a. Analytic complex function, Integral Cauchy, Laurent Series and Residu Theorm b. Complex analysis application	In class / Group, Independent and Online	100 minutes	*Lecture Power point,,*individual and group assignment sheet
13-15	Group assignment	10,11,12	Problem set	a. Laplace Theorm, Fourier Transform, Delta Dirac Funcition, Convolution Integral b. Transform Integral application	In class / Group, Independent and Online	100 minutes	*Lecture Power point,,*individual and group assignment sheet
16	Final Exam						

V. Assessment Criteria (Learning Outcome Evaluation)

Evaluation Type	Sub-CLO	Assessment Type	Frequency	Evaluation Weight (%)
Individual assignment	1-6	Individual assignment evaluation	2	25
Group assignment	7-12	Group assignment evaluation	2	25
Mid-Term Exam	1-6	Individual assignment evaluation	1	25
Final Exam	7-12	Individual assignment evaluation	1	25
Total				**100**

VI. Rubric(s)

A. Criteria of Presentation Score

Score	Presentation Delivery
85-90	Group is able to deliver the explanation logically, fluently, and punctual and be able to answer the questions from other students and lecturer
75-84	Group is able to deliver the explanation logically and fluently and be able to answer the questions from other students and lecturer, but be less punctual on delivering the explanation
65-74	Group is able to deliver the explanation fluently, but be less able to deliver the reasoning logic of the explanation
55-64	Group is less able to deliver the explanation fluently and punctual and be less able to deliver the reasoning logic of the explanation
<55	

B. Criteria of Essay Score

Score	Answer Quality
100	Answer is very precise and all the concept and main component are explained completely
76-99	Answer is fairly precise and the concept and main component are explained fairly complete
51-75	Answer is less precise and the concept and main component are explained less complete
26-50	Answer is poorly precise and the concept and main component are explained poorly complete
<25	Answer is wrong

VII. Lampiran: Contoh Soal Ujian