GOVERNMENT POLYTECHNIC, PUNE

'180 OB' – Scheme

Programme	**Diploma in CE/EE/ET/ME/MT/CM/IT/DDGM**
Programme code	**01**/02/03/04/05/06/07/**15**/16/17/18/19/**21**/22/23/24/26
Name of Course	**APPLIED MATHEMATICS III**
Course Code	**SC2101**
Prerequisite	**SC1102 – Applied Mathematics II**
Class Declaration	**No**

1. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)		Examination Scheme				
					Theory		Tutorials		Total Marks
L	T	P	C		ESE	PA	ESE	PA	
03	01	00	04	Marks	80	20	–	25	125
				Exam Duration	3 Hrs	1 Hr	–	--	—

Legends : L- Lecture, P- Practical, T- Tutorial, C- Credits ,ESE-End Semester Examination, PA- Progressive Assessment (Test I,II/TermWork) , *- Practical Exam, $- Oral Exam, #- Online Examination each Lecture/Practical period is of one clock hour;

2. RATIONALE

The student shall learn various techniques in integration and differential equations and use these techniques to their related Engineering problems.

3. COMPETENCY

The aim of this course is to help the student to attain the following industry identified Competency through various teaching learning experiences:

- **Solve various engineering related problems using the principles of applied mathematics.**

4. COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency**:**

1. Solve the given problems of integration using suitable methods.
2. Apply the concept of integration to find area under the curve and between the curve and volume of a solid revolution.
3. Solve the differential equation of first order and first degree using suitable methods.
4. Obtain partial differential equation using the suitable methods.
5. Use the concept of dot and cross product to calculate work done and moment of force about a point & line respectively.

5. SUGGESTED PRACTICALS/ EXERCISES

Sr. No.	Unit No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Relevant COs	Approx. Hrs. Required
1	1	Solve problems based on methods of integration by substitution	1	2
2	1	*Solve problems based on integration by parts.	1	1
3	1	*Solve problems based on methods of integration by partial fractions	1	1
4	2	Solve practice problems based on properties of definite integration.	2	1
5	2	*Solve practice problems based on finding area under curve, area between two curves .	2	1
6	2	*Solve practice problems based on finding volume of revolutions.	2	1
7	3	*Solve the problems based on formation, order and degree of differential equations	3	1
8	3	*Develop a model using variable separable method to related engineering problems.	3	1
9	3	Develop a model using the concept of linear differential equation to related engineering problems.	3	2
10	4	*Solve the problems based on formation of first order and second order PDE	4	1
11	4	*Application of partial differential equations and related engineering problem	4	1
12	5	Solve the problems based on algebra of vectors (Equality, addition, subtraction and scalar multiplication)	5	1
13	5	Solve the problems based on Dot (Scalar) product with properties Vector (Cross) product with properties	5	1
14	5	Solve the practice problems based on Work done and moment of force about a point & line	5	1
15	ALL	Complete a Micro- project as per the guidelines in point no. 11 towards the fulfillment of the COs of the course.	ALL	4
		Total		16

***Experiment No. 15 compulsory, perform experiment 2 or 3, experiment 5 or 6, experiment 7 or 8 and experiment 10 or 11.**

Sr. No.	Performance Indicators	Weightage in %
a.	Prepare experimental set up	-
b.	Handling of instruments during performing practical.	-
c.	Follow Safety measures	-
d.	Accuracy in calculation	20
e.	Answers to questions related with performed practices.	40
f.	Submit journal report on time	20
g.	Follow Housekeeping	10
h.	Attendance and punctuality	10
Total		**100**

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of practicals, as well as aid to procure equipment by authorities concerned**.**

Sr. No.	Equipment Name with Broad Specifications	Experiment Sr. No.
1	LCD Projector	1-14
2	Interactive Classroom	1-14

7. THEORY COMPONENTS

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Units I : Integration (09 hrs, 20 marks)	
1a. Obtain the given simple integral(s) using substitution method. 1b. Integrate given simple functions using the integration by parts. 1c. Evaluate the given simple integral by partial fractions.	1.1 Methods of Integration: a. Integration by substitution. b. Integration by parts. c. Integration by partial fractions.
Unit II: Definite integrals (09 hrs, 16 marks)	
2a. Solve given simple problems based on properties of definite integration. 2b. Apply the concept of definite integration to find the area under the given curve(s). 2c. Utilize the concept of definite integration to find the area between two curves. 2d. Invoke the concept of definite integration to find the volume of revolution of given surface.	2.1 Definite Integration: a. Simple examples b. Properties of definite integral (without proof) and simple examples. 2.2 Applications of integration : a. Area under the curve. b. Area between two curves. c. Volume of revolution.
Unit III: Differential Equations (12 hrs, 20 marks)	
3a. Find the order and degree of given differential equations 3b. Form simple differential equation for given simple engineering problems. 3c. Solve given differential equations using the method of Variable separable form. 3d. Solve the given differential equations using linear differential equations.	3.1 Concept of differential equation. 3.2 Order, degree and formation of Differential equations 3.3 Solution of differential equation a. Variable separable form. b. Linear differential equation. 3.4 Application of differential equations and related engineering problem(s).
Unit IV: Partial Differential equations (09 hrs, 12 marks)	
4a. Form partial differential equation for given simple engineering problems 4b. Solve given partial differential equations by direct integration 4c. Solve the linear partial differential equations.	4.1 Concept of partial differential equation 4.2 Formation partial differential equation 4.3 Solution of partial differential equations a. Equations solvable by direct integration b. Linear partial differential equations

Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Unit V: Vectors (09 hrs, 12 marks)	
5a. Define different types of Vectors. 5b. Find dot and cross product of vectors. 5c. Find work done and moment of force about the point and line.	5.1 Definition of vector, position vector, Algebra of vectors (Equality, addition, subtraction and scalar multiplication) 5.2 Dot (Scalar) product with properties. 5.3 Vector (Cross) product with properties. 5.4 Work done and moment of force about a point & line.

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Integration	09	04	04	12	20
II	Definite integration	09	--	08	08	16
III	Differential equation	12	04	08	08	20
IV	Partial Differential Equations	09	04	04	04	12
V	Vectors	09	04	04	04	12
Total		**48**	**16**	**28**	**36**	**80**

9. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related ***co-curricular*** activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

a. Identify engineering problems based on real world problems and solve them with the use of free tutorials available on the internet.
b. Use graphical softwares': EXCEL, DPLOT and GRAPH for related topics.
c. Use Mathcad as a Mathematical Tool and solve the problems on Calculus.
d. Identify problems based on applications of differential equations and solve these problems

10. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

a. Massive open online courses (***MOOCs***) may be used to teach various topics/subtopics.
b. About ***15-20% of the topics/subtopics*** which is relatively simpler or descriptive in nature is to be given to the students for ***self-directed learning*** and assess the development of the COs through classroom presentations (see implementation guideline for details).
c. Use Flash/Animations to explain various components, operation and
d. Teacher should ask the students to go through instruction and Technical manuals

11. SUGGESTED MICRO-PROJECTS

Only one Micro Project is planned to be undertaken by a student assigned to him/her in the beginning of the semester. She/He ought to submit it by the end of semester to develop industry oriented COs. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs. The Micro-Project could be industry application based, internet based, workshop based, laboratory based or field based. The assessment of micro-project is to be done under Practical (PA) Assessment. The Micro Project preferably assign to the group of (4-6) students or an individual taking into the considerations the capabilities and circumstances at the time

A suggested list is given here. Similar micro-project could be added by the concerned faculty.

a. Prepare charts displaying the area of irregular shapes using the concept of integration.
b. Prepare charts displaying the volume of irregular shapes using the concept of integration.
c. Prepare models using the concept of differential equations for radiocarbon decay.
d. Prepare models using the concept of differential equations for population growth.
e. Prepare models using the concept of differential equations for thermal cooling.
f. Prepare models using the concept of partial differential equation to solve engineering problems.
g. Prepare models using the concept of vector to solve engineering problems.

12. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publisher, Edition Year of publication and ISBN Number
1.	Higher Engineering Mathematics	Grewal B. S.	Khanna publication New Delhi , 2013 ISBN: 8174091955
2.	A text book of Engineering Mathematics	Dutta. D	New age publication New Delhi, 2006 ISBN: 978-81-224-1689-3
3.	Advance Engineering Mathematics	Kreysizg, Ervin	Wiley publication New Delhi 2016 ISBN: 978-81-265-5423-2
4.	Advance Engineering Mathematics	Das H.K.	S Chand publication New Delhi 2008 ISBN: 9788121903455
5.	Engineering Mathematics Volume I (4^{th} edition)	Sastry S.S.	PHI Learning, New Delhi, 2009 ISBN: 978-81-203-3616-2

13. SOFTWARE/LEARNING WEBSITES

a. *www.scilab.org/ -SCI Lab*
b. *www.mathworks.com/product/matlab/ -MATLAB*
c. *Spreadsheet Applications*
d. *www.dplot.com*
e. *https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHoPig*

14. PO - COMPETENCY- CO MAPPING

CO-PO Mapping of course

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
1	2	2	1	-	-	-	1
2	3	3	1	-	-	1	2
3	3	3	-	-	-	-	1
4	3	3	1	1	-	-	1
5	2	2	-	-	-	-	1

CO-PSO Mapping of course

	CE			ME		MT			
CO	PSO 1	PSO 2	PSO 3	PSO 1	PSO 2	PSO1	PSO 2	PSO3	PSO4
1	-	2	-	-	1	-	-	-	-
2	2	1	-	-	2	-	-	-	-
3	1	2	-	-	2	-	-	1	-
4	1	-	-	-	2	-	-	-	-
5	-	1	-	-	2	-	-	--	-

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