Government Polytechnic, Pune

'180 OB' – Scheme

Course Title: **APPLIED MATHEMATICS III**

(Course Code: SC2101.)

Diploma programme in which this course is offered	Semester in which offered
CE/ME/MT Engineering **01/04/05/21/24**	THIRD

1. RATIONALE

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

2. 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 PDE 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.

3. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				
				Theory Marks		Practical Marks		Total Marks
L	T	P	C	ESE	PA	ESE	PA	
3	1	-	4	80	20	-	25	125

4. SUGGESTED PRACTICALS/ EXERCISES

The practicals in this section are PrOs (i.e. sub-components of the COs) to be developed and assessed in the student for the attainment of the competency**:**

S. No.	Practical Exercises (Learning Outcomes in Psychomotor Domain)	Unit No.	Approx. Hrs. Required
1	Solve problems based on methods of integration by substitution	1	2
2	Solve problems based on integration by parts.	1	1

3	Solve problems based on methods of integration by partial fractions	1	1
4	Solve practice problems based on properties of definite integration.	2	1
5	Solve practice problems based on finding area under curve, area between two curves .	2	1
6	Solve practice problems based on finding volume of revolutions.	2	1
7	Solve the problems based on formation, order and degree of differential equations	3	1
8	Develop a model using variable separable method to related engineering problem.	3	1
9	Develop a model using the concept of linear differential equation to related engineering problem.	3	2
10	Solve the problems based on formation of first order and second order PDE	4	1
11	Application of partial differential equations and related engineering problem	4	1
12	Solve the problems based on algebra of vectors (Equality, addition, subtraction and scalar multiplication)	5	1
13	Solve the problems based on Dot (Scalar) product with properties Vector (Cross) product with properties	5	1
14	Solve the practice problems based on Work done and moment of force about a point & line	5	1
	Total		16

S.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**

5. 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**.**

S. No.	Equipment Name with Broad Specifications	PrO. No.
1	LCD Projector	1-14
2	Interactive Classroom	1-14

6. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to develop UOs for achieving the COs to attain the identified competency**.**

Unit	Unit Outcomes (UOs) (in cognitive domain)	Topics and Sub-topics
Units 1 : Integration	1.1. Obtain the given simple integral(s) using substitution method. 1.2. Integrate given simple functions using the integration by parts. 1.3. Evaluate the given simple integral by partial fractions.	Methods of Integration: a) Integration by substitution. b) Integration by parts c) Integration by partial fractions.
Unit 2: Definite integrals	2 .1. Solve given simple problems based on properties of definite integration. 2.2 Apply the concept of definite integration to find the area under the given curve(s). 2.3. Utilize the concept of definite integration to find area between given two curves. 2.4. 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 3: Differential Equations	3.1. Find the order and degree of given differential equations 3.2. Form simple differential equation for given simple engineering problems. 3.3. Solve given differential equations using the method of Variable separable form. 3.4 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 4: Partial Differential equations	4.1. Form partial differential equation for given simple engineering problems 4.2. Solve given partial differential equations by direct integration 4.3 Solve the linear partial differential equations.	4.1 Concept of PDE 4.2 Formation PDE 4.3 Solution of PDE's a. Equations solvable by direct integration b. Linear partial differential equations
Unit5: Vectors	5.1. Define different types of Vectors. 5.2. Find dot and cross product of vectors. 5.3. 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.

7. 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	06	08	16	20(30)
II	Definite integration	09	--	12	12	16(24)
III	Differential equation	12	06	12	12	20(30)
IV	Partial Differential Equations	09	06	08	04	12(18)
V	Vectors	09	06	04	08	12(18)
Total		**48**	**24**	**44**	**52**	**80(120)**

8. 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 with the use of free tutorials available on internet.
b. Use graphical software's:EXCEL,DPLOT and GRAPH for related topics.
c. Use Mathcad as Mathematical Tool and solve the problems on Calculus.
d. Indentify problems based on applications of differential equations and solve these problems

9. 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/sub topics.
b. About ***15-20% of the topics/sub-topics*** 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

10. SUGGESTED MICRO-PROJECTS

(Only for Class Declaration Courses)

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. In the first four semesters, the micro-project are group-based. However, in the fifth and sixth semesters, it should be preferably be ***individually*** undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. In special situations where groups have to be formed for micro-projects, the number of students in the group should ***not exceed three.***

The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than ***16 (sixteen) student engagement hours*** during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty: NA

11. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Higher Engineering Mathematics	Grewal B.S	Khanna Publications, New Delhi
2	AText Book of Engineering Mathematics	Dutta D	New Age Publications, New Delhi
3	Mathematics for Polytechnic students	S.P. Deshpande	Pune Vidyarthi Griha Prakashan
4	Advance Engineering Mathematics	H.K. Das	S. Chand & Co. Ltd. Delhi
5	Advance Engineering Mathematics	Krezig,Ervin	Wiley Publications New Dehli.

12. 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*

13. PO - COMPETENCY- CO MAPPING

(A) Program Outcomes(POs)

(What s/he will continue to do at the entry point of industry soon after the diploma Programme)

1.Basic and Discipline specific knowledge: Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the civil/mechanical /metallurgical related engineering problems.

2.Problem analysis: Identify and analyse well-defined civil/mechanical /metallurgical related engineering problems using codified standard methods.

3.Design/ development of solutions: Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs in civil/mechanical /metallurgical engineering.

4.Engineering Tools, Experimentation and Testing: Apply modern civil/mechanical /metallurgical engineering tools and appropriate technique to conduct standard tests and measurements.

5.Engineering practices for society, sustainability and environment: Apply appropriate technology in context of society, sustainability, environment and ethical practices.

6.Project Management: Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities in diverse and multidisciplinary fields.

7.Life-long learning: Ability to analyse individual needs and engage in updating in the context of technological changes in civil/mechanical /metallurgical engineering.

(B) Program Specific Outcomes (PSOs)-

Student will able to

PSO1. Use latest MECHANICAL Engineering related software's for simple design drafting and manufacturing.

PSO2. Use and operate machine, equipment and instruments related to mechanical engineering with more emphasis on automobile industry.

(C) COURSE OUTCOMES-

COURSE NAME	COURSE OUTCOMES(CO)
Applied Maths III (SC 2101)	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 PDE 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.

Name of Course: Applied Maths III
Course Code: SC 2101
Semester: III
CO-PO Matrices 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
AVERAGE	2.6	2.6	0.6	0.2	-	0.2	1.2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

CO-PSO Matrices of course

CO	PSO1	PSO2
1	-	-
2	1	-
3	1	-
4	1	-
5	-	-
Average	0.6	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

PREPARED BY:

S.N.	Name	Designation	Institute / Industry
1.		Chairman PBOS	
2.	Shri. V.B.Shinde	Faculty from Institute	Govt. Polytechnic ,Pune
3.	Mrs.P.R.Nemade	Faculty from Institute	Govt. Polytechnic ,Pune
4.		Consultant from Industry	
5.		Faculty from nearby Institute	
6.		R.B.T.E.Representative .	

14.Question Paper Profile for theory paper :

Q. No	Bit 1			Bit 2			Bit 3			Bit 4			Bit 5			Bit 6			Option
	T	**L**	**M**	**T**	**L**	**M**	**T**	**L**	**M**	**T**	**L**	**M**	**T**	**L**	**M**	**T**	**L**	**M**	
01	1	R	2	1	R	2	1	R	2	3	R	2	3	R	2	3	R	2	**08/12**
	4	R	2	4	R	2	4	R	2	5	R	2	5	R	2	5	R	2	
02	1	U	4	1	U	4	1	A	4	1	A	4	1	A	4	1	A	4	**04/06**
03	2	U	4	2	U	4	2	U	4	2	A	4	2	A	4	2	A	4	**04/06**
04	3	U	4	3	U	4	3	U	4	3	A	4	3	A	4	3	A	4	**04/06**
05	4	U	4	4	U	4	4	A	4	5	U	4	5	A	4	5	A	4	**04/06**

T= Unit/Topic Number L= Level of Question M = Marks

R-Remember U-Understand A-Analyze/ Apply