

Government Polytechnic, Pune

'180 OB' – Scheme

Course Title: MATHEMATICS III

(Course Code: SC 2103.)

Diploma programme in which this course is offered	Semester in which offered
EE Engineering	THIRD
02/22	

1. RATIONALE

The student shall learn various techniques in integration and differential equations and use these techniques to solve Electrical Engineering related 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:

- Solve the given problems of integration using suitable methods.
- Apply the concept of integration to find Mean value and Root Mean Square value.
- Solve the differential equation of first order and first degree using suitable methods.
- Using the general form of complex number find the all roots of complex number.
- Use Laplace transform to solve first order first degree differential equations.
- 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				Total Marks
L	T	P		Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	100
3	-	-	3	80	20	-	-	

4. SUGGESTED PRACTICALS/ EXERCISES

NA

5. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

NA

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.	1.1 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. Utilize the concept of definite integration to find mean value of the function 2.3. Invoke the concept of definite integration to find root mean square value of function	2.1 Definite Integration: a) Simple examples b) Properties of definite integral (without proof) and simple examples. 2.2 Applications of definite integral : a) Mean value. b) Root mean square value.
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 3.4 Solve the given linear differential equations	3.1 Concept of differential equation. 3.2 Order, degree and formation of Differential equations 3.3 Solution of differential equation Equations a. Variable separable form. b. Linear differential equation. 3.4 Application of differential equations and related engineering problem(s).
Unit 4: Complex Number	4.1. Solve given problems based on complex number. 4.2 Solve examples on complex number using De Moivre's theorem 4.3 Find roots of complex number.	4.1 Cartesian, polar and exponential form of a complex number. 4.2 Algebra of complex number. 4.3 De Moivre's theorem 4.4 General form of complex number
Unit 5: Laplace Transform	5.1 Solve the given problems based on Properties on Laplace Transform. 5.2. Solve the given problems based on Properties on Inverse Laplace Transform. 5.3 Invoke the concept of Laplace transform to solve first order first degree differential equations.	5.1 Laplace Transform of standard functions (without proof). 5.2 Properties of Laplace Transform such as linearity, first and second shifting properties (without proof). 5.3 Inverse Laplace Transform using partial fraction method, first and second shifting properties (without proof). 5.4 Laplace transform of derivatives and solution of first order first degree differential equation.
Unit 6: Vectors	6.1. Define different types of vectors 6.2. Find dot and cross product of vectors. 6.3. Find work done and moment of force about the point and line.	6.1 Definition of vector, position vector, Algebra of vectors (Equality, addition, subtraction and scalar multiplication) 6.2 Dot (Scalar) product with properties. 6.3 Vector (Cross) product with properties. 6.4 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
01	Integration	09	08	08	08	16(24)
02	Definite integration	09	02	04	12	12(18)
03	Differential equation	12	04	12	08	16(24)
04	Complex number	06	06	08	04	12(18)
05	Laplace Transform	06	06	08	04	12(18)
06	Vectors	06	06	04	08	12(18)
		Total	32	44	44	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:

- Identify engineering problems based on real world problems and solve with the use of free tutorials available on internet.
- Use graphical software's: EXCEL, DPLLOT and GRAPH for related topics.
- Use Mathcad as Mathematical Tool and solve the problems on Calculus.
- Identify 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:

- Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- 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).
- Use Flash/Animations to explain various components, operation.
- 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:

N.A.

11. SUGGESTED LEARNING RESOURCES

S. No.	Title of Book	Author	Publication
1	Higher Engineering Mathematics	Grewal B.S	Khanna Publications, New Delhi
2	A Text 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 Electrical related engineering problems.
- 2. Problem analysis:** Identify and analyse well-defined Electrical 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 Electrical engineering.
- 4. Engineering Tools, Experimentation and Testing:** Apply modern Electrical 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 analyze individual needs and engage in updating in the context of technological changes in Electrical engineering.

(B) Program Specific Outcomes (PSOs)-

Student will able to

PSO1: Work for testing, installation, operation and maintenance of various Electrical equipment.

PSO2: Work in automation and power system to solve practical problems in the field of Electrical Engineering and cope up with changing technology.

PSO3: Desing, estimate and execute Electrical installation and work as entrepreneur and /or exhibit project management skills working in a team.

(C) COURSE OUTCOMES-

COURSE NAME	COURSE OUTCOMES(CO)
Mathematics III (SC 2103)	1. Solve the given problems of integration using suitable methods.
	2. Apply the concept of integration to find Mean value and Root Mean Square value.
	3.Solve the differential equation of first order and first degree using suitable methods
	4. Using the general form of complex number find the all roots of complex number.
	5. Use Laplace transform to solve first order first degree differential equations.
	6. Use the concept of dot and cross product to calculate Work done and moment of force about a point & line respectively

Name of Course: Mathematics III

Course Code: SC-2103

Semester: III

CO-PO Matrices of course

<u>CO</u>	<u>PO1</u>	<u>PO2</u>	<u>PO3</u>	<u>PO4</u>	<u>PO5</u>	<u>PO6</u>	<u>PO7</u>
<u>1</u>	2	2	1	-	-	-	1
<u>2</u>	3	3	1	-	-	1	2
<u>3</u>	3	3	-	-	-	-	1
<u>4</u>	3	3	1	1	-	-	1
<u>5</u>	3	3	1	1	-	-	1
<u>6</u>	3	3	1	1	-	-	1
<u>AVERAGE</u>	2.8	2.8	0.8	0.5	-	0.16	<u>1.17</u>

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

CO-PSO Matrices of course

CO	PSO1	PSO2	PSO3
1	-	-	-
2	-	-	-
3	1	-	-
4	1	-	-
5	1	-	-
6	1	-	-
Averag	0.6	-	-

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

PREPARED BY:

S.N.	Name	Designation	Institute / Industry
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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	2	R	2	3	R	2	3	R	2	4	R	2	08/12
	5	R	2	5	R	2	5	R	2	6	R	2	6	R	2	6	R	2	
02	1	R	4	1	U	4	1	U	4	1	A	4	1	A	4	2	A	4	04/06
03	2	U	4	2	A	4	2	A	4	4	U	4	4	U	4	4	A	4	04/06
04	3	U	4	3	U	4	3	U	4	3	A	4	3	A	4	4	R	4	04/06
05	5	U	4	5	U	4	5	A	4	6	U	4	6	A	4	6	A	4	04/06

T= Unit/Topic Number

L= Level of Question

M = Marks

R-Remember

U-Understand

A-Analyze/ Apply