Government Polytechnic, Mumbai

Department of Civil Engineering

P-23 Curriculum

(Sandwich Pattern)

Semester-II

(Course Contents)

Government Polytechnic, Mumbai
(Academically Autonoums Institute, Government of Maharashtra)

Name of the Programme: Diploma In Civil Engineering (Sandwitch Pattern)

Teaching and examination Scheme (P23) | With Effect From Academic Year : 2023-24

Duration Of Programme : 6 Semester | Duration : 16 WEEKS

Semester : Second | Scheme : (P23)

Sr No	Course Title	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme														
					Actual Contact Hrs. / Week			Self-Learning Hrs/ Week	Notional Learning Hrs/Week		Paper Duration (hrs.)	Theory					Based on LL & TL Practical					Based on Self Learning		Total Marks
												FA-TH		SA-TH	Total		FA-PR		SA-PR			SLA		
					CL	TL	LL					T1 Max	T2 Max	Max	Max	Min	Max	Min	Max PR	Max OR	Min	Max	Min	
1	ENGINEERING MATHEMATICS	AEC	SC 23502	6	3	2	-	1	6	3	2 Hrs. 30 min.	20	20	60	100	40	25	10	-	-	-	25	10	150
2	ENGINEERING PHYSICS	DSC	SC 23102	4	3	-	2	1	6	3	2 Hrs. 30 min.	20	20	60	100	40	25	10	25#	-	10	25	10	175
3	ENGINEERING DRAWING I	DSC	ME 23101	2	4	-	4	2	10	5	-						50	20	50#	-	20	50	20	150
4	WORKSHOP PRACTICES (CE)	SEC	WS 23603	2	-	-	4	-	4	2	-	-	-	-	-	-	50	20	50@	-	20	-	-	100
5	ENGINEERING MECHANICS	DSC	AM 23101	4	3	-	2	1	6	3	2 Hrs. 30 min.	20	20	60	100	40	25	10	-	-	-	25	10	150
6	SURVEYING I	DSC	CE 23102	2	3	-	4	1	8	4	2 Hrs. 30 min.	20	20	60	100	40	25	10	25#	-	20	25	10	175
	Total			20	16	2	16	6	40	20	12	80	80	240	400	160	200	80	150	00	70	150	60	**900**

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment, IKS- Indian Knowledge System.

Legends :@ InternalAssessment, # ExternalAssessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents two class tests of 20 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLAof any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are(CL+LL+TL+SL)hrs.*15Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. *Self learning hours shall not be reflected in the Time Table.

Course Category: 1:Discipline Specific Course Core (DSC), 2:Discipline Specific Elective (DSE), 3:ValueEducation Course(VEC), 4: Intern./Apprenti./Project./Community(INP), 5:AbilityEnhancementCourse (AEC), 6: Skill Enhancement Course (SEC), 7: Generic Elective (GE)

Department Coordinator, Curriculum Development, Dept. of Civil Engineering

Head of Department, Dept. of Civil Engineering

In-Charge, Curriculum Development Cell

Principal, Government Polytechnic Mumbai

	Programme : Diploma in EE / EC / IS / CE / ME / CO / IF/AI & ML / RT		
Course Code: SC23502			**Course Title : ENGINEERING MATHEMATICS**
	Compulsory / Optional: Compulsory		

Learning Scheme and Credits						**Assessment Scheme**							
CL	**TL**	**LL**	**SLH**	**NLH**	**Credits**	**FA-TH**		**SA-TH (2Hrs.30 Min)**	**FA-PR**	**SA**		**SLA**	**Total**
						T1	**T2**			**PR**	**OR**		
3	2	--	1	6	3	20	20	60	25	--	--	25	150

Total IKS Hrs. for course: 01 Hrs

Abbreviations: CL- ClassRoom Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination
Note:
1. FA-TH represents Total of two class tests of 20 marks each conducted during the term.
2. FA-PR represents Tutorial Term work of 25 Marks
3. SLA represents self learning Assessment of 25 Marks
4. SA-TH represents the end term examination of 60 Marks

I. Rationale

An Engineering Mathematics course, covering integration, definite integration, differential equations, numerical methods, and probability distribution, equips engineering students with essential problem-solving tools. It enables them to model and analyze complex systems, make informed decisions and address real-world engineering challenges effectively.

II. Industry / Employer Expected Outcome

Engineers applying Mathematics should proficiently solve complex real-world problems, enhancing decision-making, design and innovation with precision and efficiency.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning.

CO1	Solve the broad-based engineering problems of integration using suitable methods.
CO2	Use integration to find area,volume, mean value and root mean square value for given engineering related problems.
CO3	Apply the differential equation to find the solutions of given programme specific problems.
CO4	Apply numerical methods to solve programme specific problems.
CO5	Use probability distributions to solve elementary engineering problems.

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's.	Topics / Sub-topics
1	TLO 1.1 Solve the given simple problem(s)based on rules of integration. TLO 1.2 Evaluate the given simple integral(s) using substitution method. TLO 1.3 Integrate given simple functions using the integration by parts. TLO 1.4 Solve the given simple integral by partial fractions.	**Unit-I Indefinite Integration** 1.1 Simple Integration: Rules of integration and integration of 1.2 standard functions 1.3 Integration by substitution. 1.4 Integration by parts. 1.5 Integration by partial fractions
	Course Outcome : CO1	**Teaching Hours : 9** **Marks: 10**
2	TLO 2.1 Solve given examples based on definite Integration. TLO 2.2 Use properties of definite integration to solve given problems. TLO2.3Utilize the concept of definite integration to find the following (a)Area under the curve (b)Area between given two curves (c) Volume of revolution (d) Mean value (e) Root mean square value	**Unit- II Definite Integration and Applications** 2.1 Definite Integration: Definition, rules of definite integration with simple examples 2.2 Properties of definite integral (without proof) and simple examples. 2.3 Applications of integration: area under the curve, area between given two curves, volume of revolution, mean value and root mean square value.
	Course Outcome : CO2	**Teaching Hours : 10** **Marks: 14**
3	TLO3.1 Find the order and degree of given Differential equations. TLO3.2 Form simple differential equation for given elementary engineering problems. TLO3.3 Solve given differential equations using the methods of Variable separable and Exact Differential Equation (Introduce the concept of partial differential equation). TLO3.4 Solve given Linear Differential Equation. TLO3.5 Solve given programme specific problems using the category of differential equation.	Unit-**III** Differential Equation 3.1 Concept of Differential Equation. 3.2 Order, degree and formation of Differential equations 3.3 Methods of solving differential equations:Variable separable form, Homogeneous D.E., Exact Differential Equation, Linear Differential Equation 3.4 Application of differential equations and related engineering problem(s).
	Course Outcome : CO3	**Teaching Hours : 10** **Marks: 14**

4	TLO 4.1 Find roots of algebraic equations by using appropriate methods. TLO 4.2 Solve the system of equations in three unknowns by using given methods. TLO 4.3 Apply the concept of numerical integration to solve given engineering problems. TLO 4.4 Solve problems using Yukti bhasa iterative methods for finding approximate square root. (IKS)	**Unit-IV: Numerical Methods and Numerical Integrations** 4.1 Solution of algebraic equations: Bisection method, Regula falsi method and Newton—Raphson method. 4.2 Solution of simultaneous equations containing three Unknowns by Gauss elimination method. 4.3 Solution of simultaneous equations containing three Unknowns by iterative methods: Gauss Seidal and Jacobi's method. 4.4 Numerical Integration: Trapezoidal rule, Simpson's 1/3rd rule, Simpson's 3/8 th rule. (Without proof) 4.5 Yukti bhasa iterative methods for finding approximate square root. (IKS)
	Course Outcome : CO4 **Teaching Hours : 8** **Marks: 12**	
5	TLO 5.1 Solve given problems based on repeated trials using Binomial distribution. TLO 5.2 Solve given problems when number of trials are large and probability is very small. TLO 5.3 Utilize the concept of normal distribution to solve related engineering problems.	**Unit**-V: **Probability Distribution** 5.1 Binomial distribution. 5.2 Poisson's distribution. 5.3 Normal distribution.
	Course Outcome : CO5 **Teaching Hours : 8** **Marks: 10**	

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO1.1Solve simple problems of Integration by substitution	1	Integration by substitution	2	CO1
LLO2.1Solve integration using by parts	2	Integration by parts	2	CO1
LLO3.1Solve integration by Partial fractions	3	Integration by partial fractions.	2	CO1
LLO4.1Solve examples on Definite Integral Based on given methods.	4	Definite Integral based on given methods.	2	CO2
LLO5.1Solve problems on properties of Definite integral.	5	Properties of definite integral	2	CO2
LLO6.1Solve given problems for finding The area under the curve, area between two curves and volume of revolution.	6	Area under the curve, area between two curves and volume of revolution.	2	CO2
LLO7.1Solve examples on mean value and Root mean square value.	7	Mean value and root mean square value.	2	CO2
LLO8.1Solve examples on order, degree And formation of differential equation.	8	Order, degree and formation of differential equation.	2	CO3
LLO9.1Solve first order first degree D.E. Using variable separable method	9	Variable separable method and homogeneous method.	2	CO3

and homogeneous method.				
LLO10.1Solve first order first degree D.E. Using exact differential equation and linear differential equation.	10	Exact differential equation and linear differential equation.	2	CO3
LLO11.1Solve engineering application Problems using differential equation.	11	Applications of differential equations.	2	CO3
LLO12.1Solve problems on Bisection Method and Regula falsi method.	12	Bisection Method and Regula Falsi Method	2	CO4
LLO13.1Solve problems on Newton-Raphson method and Gauss elimination method.	13	Newton-Raphson method and Gauss elimination method.	2	CO4
LLO14.1Solve problems on Jacobi's method and Gauss Seidal Method.	14	Jacobi's method and Gauss Seidal Method.	2	CO4
LLO 15.1 Solve examples on Trapezoidal rule,Simpson's1/3rd rule and Simpson's3/8 th rule.	15	Trapezoidal rule,Simpson's 1/3rd rule And Simpson's 3/8thrule.	2	CO4
LLO16.1Solve problems on Bisection method, Regula falsi method, Newton- Raphson method using spread sheet .	16	Bisection method, Regula falsi method, Newton-Raphson method problems using spreadsheet.	2	CO4
LLO17.1UseYukti bhasa iterative methods For finding approximate value of square root and cube root. (IKS)	17	Yukti bhasa iterative methods for Finding approximate value of square root and cube root. (IKS)	2	CO4
LLO18.1Solve engineering problems using Binomial distribution.	18	Binomial Distribution	2	CO5
LLO19.1Solve engineering problems using Poisson distribution.	19	Poisson Distribution	2	CO5
LLO20.1Solve engineering problems using Binomial distribution.	20	Normal Distribution	2	CO5

Note: 1. Take any 10-12 tutorials out of 20 and ensured that all the units are covered. 2. Take tutorial in the batch size of 20 to 30 students. 3. Give students at least 10 problems to solve in each tutorial.

Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

- Choose a real world problem and formulate a differential equation to model it.
- Solve the formulated differential equation and interpret the solution in the context of the problem
- Collect examples based on real world applications of Integration
- Collect examples based on real world applications of Definite Integration
- Consider a fair six-sided die. Define a discrete random variable X as the number obtained when rolling the die. Construct the probability distribution table for X
- Collect examples based on real world applications of Newton Raphson Method.
- Collect examples based on real world applications of Binomial Distribution.
- Collect examples based on real world applications of Poisson Distribution.
- Collect examples based on real world applications of Normal Distribution.

- Collect examples based on real world applications of Differential Equations
- Collect examples based on real world applications of Gauss Seidal Method.
- Collect examples based on real world applications of Gauss Jacobi's Method

Attempt any 5-7 Assignment, out of the given list

V. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Indefinite Integration	2	4	4	10
2	Definite Integration and Applications	2	4	8	14
3	Differential Equation	2	4	8	14
4	Numerical Methods and Numerical Integrations	2	4	6	12
5	Probability Distribution	2	4	4	10
	Total	10	20	30	60

VI. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

- TH- Progressive /Periodic Test test each of 20 Marks
- TL - Continuous Assessment of Tutorials for 25 Marks
- SL - Continuous Assessment of Self Learning for 25 Marks

Summative Assessment (Assessment of Learning)

- **TH -** Term End examination of 60 Marks

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1		-	1		1			
CO2	3	1			1		1			
CO3	3	2	1	1	1	1	1			
CO4	2	3	2	2	1	1	1			
CO5	2	2	1	1	2	1	2			
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

VII. Suggested Learning Materials / Books

Sr.No	Author	Title	Publisher
1	Grewal B.S.	Higher Engineering Mathematics	KhannapublicationNewDelhi,2013ISBN : 8174091955
2	Dutta. D	A text book of Engineering Mathematics	NewagepublicationNewDelhi,2006 ISBN:978-81-224-1689-3
3	Kreysizg, Ervin	Advance Engineering Mathematics	WileypublicationNewDelhi2016ISBN: 978-81-265-5423-2
4	Das H.K.	Advance Engineering Mathematics	SChandpublicationNewDelhi2008 ISBN: 9788121903455
5	S.S. Sastry	Introductory Methods of Numerical Analysis	PHILearning Private Limited, NewDelhi. ISBN-978-81-203-4592-8
6	C.S. Seshadri	Studies in the History of Indian Mathematics	Hindustan Book Agency (lndia) P19 Green Park Extension NewDelhi.ISBN978-93- 80250-06-9
7	Marvin L.Bittinger David J.E lenbogen ScottA. Surgent	Calculus and Its Applications	Addison-Wesleyl0thEditionISBN-13: 978-0-321-69433-1
8	Gareth James, Daniela Witten,Trevor Hastie Robert and Tibshirani	An Introduction to Statistical Learning with Applications in R	Springer NewYork Heidelberg Dordrecht LondonISBN978-1-4614-7137-0ISBN 978-1-4614-7138-7(eBook)

VIII. Learning Websites & Portals

Sr.No	Link /Portal	Description
1	https://www.wo1frama1pha.com/	Solving mathematical problems, performing calculations, and visualizing mathematical concepts.
2	http://www.sosmath.com/	Free resources and tutorials
3	http://mathworld.wolfram.com/	Extensive math encyclopedia with detailed explanations of mathematical concepts
4	https://www.mathsisfun.com/	Explanations and interactive lessons covering various math topics, from basic arithmetic to advanced
5	http://tutorial.math.1amar.edu/	Comprehensive set of notes and tutorials covering a wide range of mathematics topics, including calculus
6	https://www.purplemath.com/	Purple math is a great resource for students seeking help with algebra and other foundational math
7	https://www.brilliant.org/	Interactive learning in Mathematics
8	https://www.edx.org/	Offers a variety of courses
9	https://www.coursera.org/	Coursera offers online courses in applied mathematics from universities and institutions around the
10	https://ocw.mit.edu/index.htm	The Massachusetts Institute of Technology (MIT) offers free access to course materials for a wide range

IX.Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr.Santosh Bhandekar	Lecturer in Mathematics	Government Polytechnic, Osmanabad
2	Mr.Abhijit S.Patil	Lecturer in Mathematics	Government Polytechnic ,Mumbai
3	Mr.Vinod S.Patil	Lecturer in Mathematics	Government Polytechnic ,Mumbai

Coordinator,
Curriculum Development,
Department of _____ Engineering

Head of Department
Department of _____ Engineering

I/C, Curriculum Development Cell

Principal

Programme: Diploma in CE/ME/RT													
Course Code:SC23102					**Course Title: Engineering Physics**								
Compulsory / Optional: Compulsory													
Learning Scheme and Credits						**Assessment Scheme**							
CL	**TL**	**LL**	**SLH**	**NLH**	**Credits**	**FA-TH**		**SA-TH (2:30Hrs.)**	**FA-PR**	**SA**		**SLA**	**Total**
										PR	**OR**		
3	-	2	1	6	3	20	20	60	25	25#	-	25	175

Total IKS Hrs. for course: 2hrs.

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
1. FA-TH represents two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.
3. FA-PR represents the term work.
4. SA-PR represents the end term practical examination.

I. Rationale

The subject is included under the category of science. The special feature of the subject is to develop the laboratory skill using principles of scientific phenomenon. This course will serve to satisfy the need of the technical students for their development in technical field. The course is designed by selecting thetopics which will develop intellectual skills of the students and will guide students to solve broad based engineering problems. Ultimately the focus of the course is to develop psychomotor skills in the students.

II. Industry / Employer Expected Outcome

Physics is a fundamental science that plays a crucial role in various industries and has numerous outcomes that benefits society: Apply principles of physics to solve broad based relevant engineering problems.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Classify the different physical quantities, identify the proper unit of it and to estimate in the measurement of physical quantities.
CO2	Apply laws of motion in various engineering applications.
CO3	Identify the properties of solid, liquid such as elasticity, viscosity and surface tension.
CO4	Analyze types of waves.
CO5	Create awareness about the properties and application of light and Nanotecnoloy in engineering field.

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's)aligned to CO's	Topics / Sub-topics
1.	**TLO 1a.** Explain physical quantities and its types with examples. **TLO 1b.** Differentiate between scalar and vector quantities with examples. **TLO 1c**. Apply dimensional analysis to check correctness of equation and conversion of units in different systems. **TLO 1d.** Estimate the errors in the measurement for the give problem. **TLO 1e.** Explain the working of ancient astronomical instruments to measure distance, time and hour angle	**Units and Measurements** 1.1 Fundamental Physical quantities, examples. 1.2 Derived physical quantities, examples. 1.3 Scalar and Vector Physical Quantities. 1.4 Definition and requirements of unit 1.5 System of units, C. G. S., M. K. S. and S. I. units. 1.6 Dimensions, dimensional formula 1.7 `Rules to write the unit and conventions of units and Significant figures, rules to write significant figures 1.8 Error – Definition, types of errors and estimation of errors. 1.9 Ancient astronomical instruments: Chakra, Dhanyata, Yasti and Phalak yantra, Numerical **Course Outcome: CO1** **Teaching Hours :5hrs.** **Marks: 8**
2.	**TLO2a.** Differentiate between velocity and speed. Identify changes in motion that produce acceleration. Able to calculate speed, velocity and acceleration of an object, analytically, Classify acceleration as positive, negative, and zero. **TLO2b.** Identify different periodic motion with examples such as oscillatory motion, Vibratory motion, circular motion. **TLO2c**. Explain angular motion with equation of angular motion, explain relation between linear velocity and angular Velocity, understand the concept of centripetal and centrifugal force **TLO2d.** Describe real-life situations that illustrate each of Newton's laws of motion. **TLO2e.** Explain the laws of motion.	**Motions** 2.1 **Linear motion** –Definition – distance, displacement, velocity, acceleration, retardation, equation of motions, acceleration due to gravity and equation motion under gravity, numerical 2.2 **Periodic motions:** a) Oscillatory motion, b) Vibratory motion, c) S.H.M. d) Circular motion. (only definition and examples) , terms related to S.H.M. : Definition: Time period,frequency, amplitude, wavelength, and phase 2.3 **Angular motion:** a) Definition: angular motion, Uniform circular motion, Radius vector,linear velocity, Angular velocity, Angular acceleration, b) Relation between linear velocity and angular Velocity(derivation), Radial or centripetal acceleration, Three equations of motion (no derivations), Centripetal

		and Centrifugal force,examples and applications. 2.4. Laws of Motion and it's applications. 2.5. Numerical. **Course Outcome: CO2** **Teaching Hours :12hrs** **Marks: 14**
	TLO a. Calculate elastic constants and state their significance **TLO b.** Distinguish between elasticity, surface tension and viscosity **TLO d.** Determine surface tension and viscosity of fluid **TLO e.** Deforming force, restoring force, elasticity, plasticity and rigidity, factors affecting elasticity, stress and strain with their types, elastic limit, Hooke's law **TLO h.** Classify types of flow of fluid	**General Properties of Matter** **3.1 Elasticity:** 3.1.1 Deforming force, restoring force, Elastic, plastic and rigid substances, and their examples. 3.1.2 Definition of elasticity, stress, strain and its types. 3.1.3 Hooke's Law and elastic limit. 3.1.4 Stress - Strain curve, yield point, breaking point. 3.1.5 Young's Modulus, Bulk modulus and Modulus of rigidity, Definition and relation among them. 3.1.6 Numerical. **3.2 Viscosity** 3.2.1 Concept and Definition of viscosity, velocity gradient. 3.2.2 Newton's law of viscosity, Co-efficient of viscosity, unit of viscosity 3.2.3 Stokes' law, terminal velocity, derivation of Stokes' formula. 3.2.4 Streamline flow, turbulent flow, critical velocity, examples. 3.2.5 Reynolds' number and its significance. 3.2.6 Numerical. **3.3 Surface Tension:** 3.3.1 Concept of surface tension. 3.3.2 Adhesive and cohesive forces, examples. 3.3.3 Laplace's Molecular theory of surface tension 3.3.4 Angle of contact, its significance. **Course Outcome: CO3** **Teaching Hours: 14hrs.** **Marks: 16**
4.	**TLO a.** Identify various properties of sound waves. **TLO b.** Differentiate between sound and other types of waves. **TLO b.** Describe how sound wave properties affect how sound is perceived.	**Sound** 4.1 Sound Waves: 4.1.1 Wave motion, types of waves – progressive, longitudinal and transverse waves. 4.1.2 Characteristics of longitudinal and transverse waves and comparison. 4.1.3 Free or natural vibrations and forced vibrations, resonance – definition and examples. 4.1.4 Determination of velocity of sound by resonance method. 4.1.5 Numerical. 4.1.6 Resonance concept in prehistoric times, concept of different frequencies (Mantras) used to ignite different chakras in body (IKS).

		Course Outcome: CO4 **Teaching Hours: 5 hrs.** **Marks: 8**
5.	**TLO 5a.** Explain refraction and reflection of light. **TLO 5b**. Explain refraction of lit through prism. **TLO 5c.** Estimate refractive index of material of prism. **TLO 5d.** Derive Prism Formula. **TLO 5e.** Explain the phenomenon of total internal reflection. **TLO 5f.** Describe the workings and uses of fibre optics. **TLO 5g.** Describe the nanotechnology and properties of nanomaterials and its various applications.	**Optics, Optical Fiber and Nanotechnology** **5.1 Optics:** 5.1.1 Revision of reflection and refraction of light. 5.1.2 Laws of refraction, Snell's law. 5.1.3 Determination of refractive index. 5.1.4 Dispersion, Prism formula (derivation) 5.1.5 Critical angle, Total internal reflection. Examples and applications. 5.1.6 Numerical. **5.2 Optical Fiber:** 5.2.1 Principle of propagation of light through optical fiber. 5.2.2 Structure of optical fiber. 5.2.3 Applications. 5.2.4 Difference between optical fiber cable and electric cable wire. **5.3 Nanotechnology** 5.3.1 Introduction to nanotechnology. 5.3.2 Definition of Nano scale, manometer and nanoparticles, Nanotechnology. 5.3.3 Definition and examples of nanostructured materials, Physical and chemical properties of nanomaterial. 5.3.4 Applications of nanotechnology in different fields - a) electronics, b) automobile, c) medical, d) textile, e) Cosmetics, f) environmental, **Course Outcome: CO5** **Teaching Hours: 9 hrs.** **Marks: 14**

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Practical / Tutorial / Laboratory Learning Outcome (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	**LLO a.** Use of measuring instruments **LLO b.** Find the least count and range of the instruments. **LLO c.** Interpretation of graph and use of scientific calculator.	To know your Physics laboratory and use of scientific calculator.	2	CO1

2	**LLO a.** Use Vernier caliper to Measure dimensions of given objects. Measure the dimensions of objects of known dimensions. **LLO b.** Estimate the errors in measurement.	To measure the dimensions of given objects and to determine their Volume using Vernier caliper.	2	CO1
3	**LLO a.** Identify types of motion **LLO b.** Determine the value of acceleration due to gravity.	To determine Acceleration due to gravity by simple pendulum	2	CO2
4	**LLO a.** Explain Elastic moduli. **LLO b.** Understand the relation between Young's modulus, Bulk modulus and rigiditymodulus of elasticity	To determine Elastic moduli of a given wire byusing Searle's apparatus.	2	CO3
5	**LLO a.** Study properties of liquid **LLO b.** Calculate coefficient of viscosity of liquid	To determine coefficient of viscosity of liquid by Stokes' method	2	CO3
6	**LLO a.** Understand the theory of the surface tension of liquids. **LLO b.** Correlate the property of surface tension with different natural phenomena. **LLO c.** Understand the concept of capillarity in liquids. **LLO d.** Relate surface tension and capillarity. Find the value of surface tension of a given liquid.	To determine the surface tension of liquid using capillary rise method.	2	CO3
7	**LLO a.** Understand the concept of sound waves and the various terms related to them **LLO b.** Understand transverse and longitudinal waves. Find the velocity of sound in air.	To determine velocity of sound by resonance method.	2	CO4
8	**LLO a.** Explain refraction of light. **LLO b.** Determine refractive index of a given prism	To determine refractive index by using pin method	2	CO5
9	**LLO a.** Use Micrometer Screw gauge to: Measure dimensions of given objects. Measure the dimensions of objects of known dimensions. **LLO b.** Estimate the errors in measurement.	To measure the dimensions of given objects and to determine theirVolume using micrometer screw gauge.	2	CO1
10	**LLO a.** Identify type of motion **LLO b.** Calculate the stiffness constant	To determine stiffness constant by using helical spring	2	CO2
11	**LLO a.** Study the properties of light TIR **LLO b.** Determine the critical angle	To study total internal reflection and to determine the critical angle.	2	CO5
12	**LLO a.** Understand the concept of sound waves and the various terms related to them **LLO b.** Understand transverse and longitudinal waves. Find the velocity of sound in air.	To determine velocity of sound by using sonometer.	2	CO4
13	**LLO a.** Study the types of motion. **LLO b.** Use of projectile motion in sport.	To study projectile motion	2	CO2
14	**LLO a.** Apply engineering and physics concepts to the nano-scale and non-continuum domain. **LLO b.** To apply mathematics and science in engineering applications.	To study applications of nanotechnology in engineering field.	2	CO5

15	**LLO a.** Define unit and classify into different types of units	Showing Video on different applications related to units,	2	CO1

Note: 10 to 12 experiments should be performed in a term for completion of TW.

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

1. Convert the units of a given physical quantity from one system of units to another
2. Measure room temperature of hot baths / bodies by using mercury thermometer and convert it into different units.
3. Prepare a chart to summarize units and measurements
4. Use a digital vernier calliper and micrometre screw gauge for measurements. (Lab- based).
5. Make a paper scale of least count e.g. 0.01 cm, 0.2cm, 0.5cm.
6. What is the difference between speed and velocity?
7. What is motion? Describe Straight line motion.
8. Explain Average speed and Average velocity.
9. Write in detail about your experience of various, types of motion while riding a bicycle on a road.
10. Identify the types of motion.
    (a) Movement of the earth around the sun: ..... .
    (b) Movement of a ceiling fan: .....
    (c) A meteor falling from the sky: ..... .
    (d) A rocket launched from the ground: .....
    (e) A fish swimming in water: .....
    f) The plucked string of a sitar: ...
11. Compare elastic body and plastic body (lab based).
12. Write the practical applications of Elasticity.
13. Write the practical applications of Viscosity.
14. Compare streamline and turbulent flow with examples.
15. Write T for True and F for false statements:
    1. Sound is produced by a vibrating body.
    2. All objects produce same type of sound.
    3. Guitar is a musical instrument.
    4. The number of complete waves or cycles produced by a vibrating body in one second is called frequency.
    5. The pitch of a sound is independent of the frequency of vibrations.
    6. Flute is a stringed instrument.
    7. The loudness of sound is a measure of the sound energy reaching the ear per second.
    8.. Loudness of a sound depends on the area of vibrating body only.
    9. Hertz is the unit to measure the intensity of loudness.
    10. Noise pollution can cause permanent hearing loss.
16. What is noise pollution? Write a note on the ill effects of noise pollution.
17. Why is the sound of siren in an ambulance or a Fire tender different from the horns used by other vehicles?
18. Circle the odd one out.

1. Tabla, Drums, Mridangam, Guitar
2. Flute, Saxophone, Sitar, Shehnai
3. Vacuum, Amplitude, Frequency, Loudness
4. Veena, Drum, Sitar, Violin
5. Sound of birds, Sound of a fan, Sound of a baby, Sound of a cracker
6. Drums, Shehnai, Speaker, Guitar
7. Hertz, Decibel, Frequency, Watt
8. Temperature, Amplitude of Vibrations, Area off Vibrating body, Distance from listener

19. Match the columns.

1. Hertz	a. Unit to measure intensity of sound
2. A stringed instrument	b. An overtone and a fundamental tone at a fixed interval
3. Pitch	c. Loudest and lowest notes
4. Membrane instrument	d. Guitar
5. Monotone	e. SI unit of frequency
6. Decibel	f. Drums
7. Harmonics	g. Sensation of a frequency
8. Fundamentals	h. Sound with single tone

20. To demonstrate T.I.R and working of optical fiber (lab based)

VI. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Units and Measurements	2	4	2	8
2	Motions	4	4	8	16
3	General properties of matter	4	6	8	18
4	Sound Waves	2	4	2	8
5	Optics and Optical fiber	2	4	4	10
Total		**14**	**22**	**24**	**60**

VII. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

- Rubrics for continuous assessment based on process and product related performance indicators (25 marks)

Summative Assessment (Assessment of Learning)

- End term examination, Viva-voce (25 marks)

VIII. Suggested COs - POs Matrix Form(CIVIL ENINEERING)

	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	**PO-2 Problem Analysis**	**PO-3 Design/ Development of Solutions**	**PO-4 Engineering Tools**	**PO-5 Engineering Practices for Society, Sustainability and Environment**	**PO-6 Project Management**	**PO-7 Life Long Learning**	**PSO-1**	**PSO-2**	**PSO-3**
CO1	3	1	1	2	1	1	1	2	1	--
CO2	3	--	1	---	1	1	1	2	1	1
CO3	3	1	1	---	1	1	1	1	1	
CO4	3	1	1	2	1	1	1	2	1	1
CO5	3	1	1	2	---	1	1	1	--	--
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

VIII. Suggested COs - POs Matrix Form(MECHANICAL ENINEERING)

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	**PO-2 Problem Analysis**	**PO-3 Design/ Development of Solutions**	**PO-4 Engineering Tools**	**PO-5 Engineering Practices for Society, Sustainability and Environment**	**PO-6 Project Management**	**PO-7 Life Long Learning**	**PSO-1**	**PSO-2**	**PSO-3**
CO1	3	1	1	2	1	1	1	2	---	---
CO2	3	1	1	---	1	1	1	1	1	---
CO3	3	1	1	---	1	1	1	2	1	---
CO4	3	---	1	2	1	1	1	2	---	---
CO5	3	1	1	2	---	1	1	1	--	---
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

VIII. Suggested COs - POs Matrix Form(RUBBER TECNOLOY)

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1	1	2	1	1	1	2	---	---
CO2	3	1	1	---	1	1	1	1	1	---
CO3	3	1	1	---	1	1	1	2	1	---
CO4	3	---	1	2	1	1	1	2	---	---
CO5	3	1	1	2	---	1	1	1	--	---
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

IX. Suggested Learning Materials / Books

Sr.No	Author	Title	Publisher
1	R K Gaur &; S L Gupta	Engineering Physics	Dhan pat Rai Pub.
2	Prof. Arthur Beiser	Applied Physics	Tata McGraw hill Pub.
3	D K Bhattacharya	Engineering Physics	Oxford University press
4	NCERT / MSBSHSE	Physics 1 & 2	NCERT/MSBSHSE
5	Halliday &Resnick Wiley	Physics Vol 1 & 2	Wiley India
6	Brijlal & Subrahmanyam	Principle of physics	S. CHAND & COMPANY
7	R K Gaur & S L Gupta.	Engineering Physics	Dhan pat Rai Pub.

X. Learning Websites & Portals

Sr.No	Link / Portal	Description
1	https://sunitathorat1310.wixsite.com/website-1	Unit and Measurements. Motion, properties of matter, Sound wave, Optics and Optical fiber, Nanotecnoloy
2	www.physicsclassroom.com	Concept of basic physics
3	www.physics.org	Concept of basic physics
4	www.physics.brown.edu	Concept of basic physics
5	www.amazon.com/Basic-Physics	Concept of basic physics
6	http: //scienceworld.wolfram.com/physics/	Concept of basic physics
7	http: //en.wikipedia.org/wiki	Concept of basic physics
8	http: //hyperphysics.phy-astr.gsu.edu/hbase	Concept of basic physics
9	www.msu.edu/~brechtjo/physics	Concept of basic physics
10	www.answers.com/topic/list-of-basic-physics-topics	Concept of basic physics
11	www.answers.com/topic	Unit and Measurements. Motion, properties of matter, Sound wave, Optics and Optical fiber, Nanotecnoloy
12	www.vlab.amrita.edu	All Experiments video
13	www.olabs.edu.in	All Experiments video
14	https: //praxilabs.com/en/	All Experiments video
15	www.phet.colorado.edu	Simulation of Topics

XI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr.Y.A. Mahajan	Selection grade Lecturer in physics	Bhausaheb Vartak Polytechnic, Vasai
2	Mr. S.S. Salve	Senior Lecturer in physics	S.B.M. Polytechnic, Vile -Parle
3	Mrs.B.J. Chaudhari	Lecturer in physics	Government Polytechnic, Thane
4	Mrs. S.A. Thorat	Lecturer in physics	Government Polytechnic, Mumbai

Coordinator,
Curriculum Development,
Department of_____Engineering

Head of Department
Department of_____Engineering

I/C, Curriculum Development Cell

Principal

Programme: Diploma in Mechanical Engineering/ Civil Engineering													
Course Code: ME23101					**Course Title: Engineering Drawing-I**								
Compulsory / Optional: Compulsory													
Learning Scheme and Credits						**Assessment Scheme**							
CL	**TL**	**LL**	**SLH**	**NLH**	**Credits**	**FA-TH**		**SA-TH**	**FA-PR**	**SA**		**SLA**	**Total**
						T1	**T2**			**PR**	**OR**		
4	-	4	2	10	5	-	-	-	50	50#	-	50	150

Total IKS hrs. for course: 2

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
1. FA-TH represents two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

Engineering Drawing is the graphical language of engineers, technicians and workers to express engineering ideas and concepts. Correct interpretation of engineering drawings is one of the basic abilities of First Line Supervisors in industries. Study of Engineering Drawing induces the concepts of accuracy and exactness of information necessary for the production of engineering component. It also develops judgements about distances and angles.

This basic course aims at building a foundation for the further courses in drawing and other allied courses. This course introduces the concept of reference planes and the projections. The self -Learning activities indicated in the curriculum are helpful for students to revise the learned concepts and will develop their self-confidence in course learning.

This course is useful in developing imagination, drafting and sketching skills of the students.

II. Industry / Employer Expected Outcome

To prepare and interpret the technical drawings.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course-based learning-

CO1	Draw geometrical constructions and engineering curves using drawing instruments.
CO2	Apply the principles of first angle method of projections to draw views of line and plane.
CO3	Apply principles of orthographic projections to draw orthographic views of given object.
CO4	Apply principles of isometric projections to draw isometric view from given orthographic views.
CO5	Draw the free hand sketches of given engineering objects/elements

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO's) aligned to CO's.	Topics / Sub-topics
1	1.1 Draw engineering figures using geometric constructions with the help of drawing instruments. 1.2 Use IS SP-46 for dimensioning 1.3 Use different types of lines.	**Basics of Engineering Drawing** 1.1 Drawing instruments and their uses, Standard sizes of drawing sheets (ISO-A series), Letters and numbers (single stroke vertical), Types of lines and their applications, Drawing Scales (reduced, enlarge and full size), Methods of Dimensioning: Chain, parallel and coordinate dimensioning (Refer SP-46 Code) 1.2 Simple Geometrical Constructions, Redrawing figures using geometrical constructions **Course Outcome-CO1 Teaching Hours – 08 Marks –06**
2	2.1 Draw different engineering curves from given data. 2.2 Plot loci of points from given data.	**Engineering Curves and Loci of Points** 2.1 Method to draw Ellipse by Arcs of Circle Method and Concentric Circle Method 2.2 Method to draw Parabola and Hyperbola by Directrix and Focus Method. 2.3 Methods to draw Involutes of circle and pentagon, 2.4 Methods to draw Cycloid, 2.5 Loci of Points of Single Slider Crank Mechanism **Course Outcome-CO1 Teaching Hours – 10 Marks –06**
3	3.1 Draw top, front and side views of a line from given data. 3.2 Draw top, front and side views of a plane form given data.	**Projection of lines and planes** 3.1 Concepts of Reference Planes and Projections, Views – Top, Front, Side Views 3.2 Projections of Line inclined to one reference plane (H. P/V. P) and limited to both ends in one quadrant only. 3.3 Projections of simple planes of circular, rectangular, pentagonal and hexagonal shape, inclined to one reference plane and perpendicular to another plane. **(First Angle Projection Method Only)** **Course Outcome- CO2 Teaching Hours – 10 Marks –10**

Unit No.	Theory Learning Outcomes (TLO's) aligned to CO's.	Topics / Sub-topics
4	4.1 Draw top, front and side views of given pictorial view. 4.2 Draw the top, front and side sectional orthographic views from given pictorial view.	**Orthographic Projections** 4.1 Introduction to orthographic projections, Symbol of First Angle Projection and Third angle projection, Conversion of pictorial view into orthographic views –Top, Front and side View of objects. Objects involving plain surfaces, slant surfaces, slots, ribs, cylindrical surfaces. 4.2 Sectional Orthographic Views and conversion of pictorial view into sectional Orthographic views (Objects involving plain surfaces, slant surfaces, slots, ribs, cylindrical surfaces, threads etc.) **(First Angle Projection Method Only)** **Course Outcome- CO3 Teaching Hours – 16 Marks –12**
5	5.1 Draw isometric scale. 5.2 Draw isometric views from given orthographic view using natural and isometric scale.	**Isometric projections** 5.1 Isometric scale, Natural scale. 5.2 Conversion of Orthographic Views into Isometric View/Projection (Objects involving plain surfaces, slant surfaces, slots, ribs, cylindrical surfaces, holes etc.) **Course Outcome- CO4 Teaching Hours – 10 Marks –12**
6	6.1 Draw proportionate free-hand sketches of given elements.	**Free hand sketches** 6.1 Drawing of proportional freehand sketches of – Different types of thread profile, nuts, bolts, screws, washers and foundation bolts (Rag and Lewis type) **Course Outcome- CO5 Teaching Hours – 06 Marks –04**

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Laboratory Learning Outcome **(LLO)** aligned to CO's.	**Laboratory Experiment / Practical Titles / Tutorial Titles**	**Number of hrs.**	**Relevant COs**
1	1.1 Prepare Lettering, 1.2 Draw types of lines. 1.3 Redraw the given figure. 1.4 Apply IS code provisions for to dimensioning.	Basics of Engineering Drawing Drawing sheet containing types of lines, Lettering, Redrawing given figure, dimensioning	08	CO1
2	2.1 Draw Engineering curves using given data.	Engineering curves and loci points (minimum 4 problems)	08	CO1
3	3.1 Apply the method of projection to draw views of	Projections of Lines and Planes Three cases on lines and three cases on planes	08	CO2

Sr No	Laboratory Learning Outcome **(LLO)** aligned to CO's.	**Laboratory Experiment / Practical Titles / Tutorial Titles**	**Number of hrs.**	**Relevant COs**
	lines from given data. 3.2 Apply the method of projection to draw views of planes from given data.			
4	4.1 Apply method of projection for drawing orthographic views.	Orthographic projections Using first angle method of projections (minimum 2 problems)	12	CO3
5	5.1 Apply method of projection for drawing sectional orthographic views.	Sectional Orthographic projections Using first angle method of projection (minimum 2 problems)	08	CO3
6	6.1 Draw isometric projections using natural and isometric scale.	Isometric Projections Using isometric scale (1 objects) and natural scale (1 object)	08	CO4
7	7.1 Draw standard discipline-oriented components using free hand	Free hand sketches To draw free hand sketches of different types of threads forms, nuts, bolts and screws, foundation bolts.	06	CO5
8	8.1 Collect information of an ancient Indian culture related to engineering graphics	Correlate ancient Indian sculptures, Indian temples, Monuments, etc. with Engineering Graphics.	02	C01

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

Each student has to maintain a A3 size sketch book and complete following assignments for assessment of self-learning activity.

1. Draw horizontal, vertical, 30º, 45º, 60º, 75º using set square and drafter, and geometric constructions
2. Draw different types of lines & redraw two figures
3. Solve two problems each on projections of lines and planes
4. Two problems on orthographic projections (out of which one problem on sectional orthographic)
5. Two problems on isometric projections
6. Free hand sketches
7. Co-relate ancient Indian sculptures, Indian temples, monuments etc. with engineering drawing

VI. Specification Table:

Unit No	Topic Title	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	**Basics of Engineering Drawing**	-	-	06	06
2	**Engineering Curves and Loci of Points**	-	-	06	06
3	**Projection of lines and planes**	-	-	10	10
4	**Orthographic Projections**	-	-	12	12
5	**Isometric projections**	-	-	12	12
6	**Free Hand Sketches**	-	-	04	04
	Total	-	-	**50**	**50**

VII. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

Each sheet/ self-learning assignment to be assessed on following rubrics (10 marks)

Attendance & Regularity	Technical Understanding & Interpretation of given problem	Line work, Accuracy, Presentation	Total
02 Marks	04 Marks	04 Marks	10 Marks

Summative Assessment (Assessment of Learning)

End term practical examination of TWO hrs. (50 marks)

VIII. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO- 1	PSO- 2
CO1	03	-	-	03	-	-	02	01	-
CO2	03	-	-	03	-	-	02	01	-
CO3	03	-	-	03	-	-	02	03	02
CO4	03	-	-	03	-	-	02	03	02
CO5	03	-	-	03	-	-	02	02	02
Legends: - High:03, Medium:02, Low:01, No Mapping: --									

IX. Suggested Learning Materials / Books

Sr.No	Author	Title	Publisher
1	N.D.Bhatt	Engineering Drawing	Charotar Publishing House
2	P.J. Shah	Engineering Graphics	S. Chand
3	Amar Pathak	Engineering Drawing	Wiley Publication
4	D.Jolhe	Engineering Drawing	Tata McGraw Hill Education
5	K.L.Narayan,P.Kannaiah	Textbook on Engineering Drawing	Scitech publications
6	BIS	IS Code SP-46, Engineering Dawing practice For school and colleges	BIS

X. Learning Websites & Portals

Sr.No	Link / Portal	Description
1	https://ocw.mit.edu/courses/2-007-design-and-manufacturing-i-spring-2009/pages/related-resources/drawing_and_sketching/	MIT Open courseware describing basics of engineering drawing
2	https://archive.nptel.ac.in/courses/112/104/112104172/	Lectures on Technical Drawing
3	https://www.youtube.com/watch?v=3WXPanCq9LI	Projection of lines
4	https://www.youtube.com/watch?v=fvjk7PlxAuo	Introduction to Graphics (GTU)

XI. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Mr. K.B. Salunke	Lecturer in Mechanical Engineering	Government Polytechnic, Thane
2	Dr. V.P. Rathod	Lecturer in Mechanical Engineering	Government Polytechnic, Thane
3	Mr. U.A. Agnihotri	Lecturer in Mechanical Engineering	Government Polytechnic, Mumbai
4	Mr. S. B. Bidgar	Lecturer in Mechanical Engineering	Government Polytechnic, Mumbai
5	Mr. E.C. Dhembare	Lecturer in Mechanical Engineering	Government Polytechnic, Mumbai

Coordinator,
Curriculum Development,
Department of Mechanical Engineering

Head of Department
Department of Mechanical Engineering

I/C, Curriculum Development Cell

Principal

Programme : Diploma in Mechanical Engineering (Sandwich Pattern)													
Course Code: WS23603					**Course Title : Workshop Practices (CE)**								
Compulsory / Optional: Compulsory													
Learning Scheme and Credits						**Assessment Scheme**							
CL	**TL**	**LL**	**SLH**	**NLH**	**Credits**	**FA-TH**		**SA-TH (2 Hrs. 30 min.)**	**FA-PR**	**SA**		**SLA**	**Total**
						T1	**T2**			**PR (2Hrs)**	**OR**		
--	--	04	--	04	02	--	--	--	50	50@	--	--	100

Total IKS Hrs. for course: 02

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:

1. FA-TH represents two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

Workshop Practice is a basic engineering course. The knowledge of basic shops like wood working, fitting, plumbing is essential for technician to perform his/her duties in industries. Studentsare able to perform various operations using hand tool equipment and machineries in various shops. Working in workshop develops the attitude of group working and safety awareness. This course provides industrial environment inthe educational institute.

II. Industry / Employer Expected Outcome

Use different engineering tools for performing shop floor activities.

III. Course Outcomes: At the end of the course students will be able to

CO1	Use firefighting tools and equipment.
CO2	Perform lineout activity.
CO3	Select and Prepare plumbing joints.
CO4	Prepare job using different tools in fitting shop.
CO5	Produce a utility product/job using carpentry tools job.

Course Content Details:

Unit No.	Theory Learning Outcomes(TLO's)	Topics / Sub-topics
1	1.1 Explain the safety practices & precautions while operating firefighting equipment. 1.2 Explain the procedure for using the given type of fire extinguisher. 1.3 Justify the given type of firefighting equipment for the given situation. 1.4 Prepare a list of equipment used for safety in workshop operations. 1.5 Maintain the good housekeeping in the working area 1.6 Prepare a layout of workshop	**Unit - I Safety Practices & Precautions** 1.1 Safety Practices, Causes of accidents, General safety les, Safety signs and symbols, Safety Precaution. 1.2 First Aid box and its constituent materials. 1.3 Fire, Causes of Fire, Basic ways of extinguishing the fire Classification of fire, 1.4 Firefighting equipment, fire extinguishers (Class A, B, C, D). (As per NBC 2016). **1.5** Workshop Layout: Issue and return system of tools, equipment and consumables **Course Outcome : CO1 Practical Hours :10**
2	2.1 Explain the basic activities to be undertaken for the construction of the given component of civil structure. 2.2 Lay the foundation layout on site using relevant techniques. 2.3 Explain the safety precautions to be undertaken at the given construction site.	**Unit - II Construction Activities** 2.1 Construction activities such as layout, excavation, brick masonry, concreting, plumbing, Electrification, Interdependency of various activities. 2.2 Causes of accidents, Safety Practices and Precaution **Course Outcome : CO2 Practical Hours :16**
3	3.1 Undertake the plumbing operation for the given situation. 3.2 Select the relevant tools to perform the given plumbing work. 3.3 Use the concerned tools to lay the pipe line of required specification using relevant fittings 3.4 Draw the flow chart describing the laying operations of water supply pipe line from overhead tank to the given flat/house..	**Unit - III Plumbing** 3.1 Different types of pipes, Joints, Taps. Fixtures and accessories used in plumbing. 3.2 Components (pipes, valves bends.) used in water supply/sanitary/ sewerage lines. 3.3 Pipe fittings- bends, elbows, tees, cross, coupler, socket, reducer, cap, plug, nipple and their Specifications 3.4 Various Operation in plumbing shops- pipe bending machine their specifications and Maintenance. Basic process cutting, threading etc. **Course Outcome : CO3 Practical Hours :10**

4	4.1 Identify fitting tools 4.2 Explain operation of fitting shop machines 4.3 Use fitting tools 4.4 Operate machineries. 4.5 Perform fitting operations , Maintain tools, equipment and machineries	**Unit - IV Fitting** 4.1 Fitting hand tools bench vice, hammers, chisels, files, hacksaw, surface plate, punch, v block, angle plate, try square, marking block , steel rule, twist drills, reamers, tap set, die set and their Specifications 4.2 Basic operations in fitting shop: chipping, filling, scraping, grinding, marking, sawing, drilling, tapping, reaming etc. 4.3 Fitting shops machineries: Drilling machine, Power saw, grinder their specifications**.** 4.4 Safety practices to be followed in fitting shop 4.5 Preparation of male, female joint. **Course Outcome : CO4 Practical Hours :10**
5	5.1Identify different types of woods. 5.2 Select wood working tools as per job/ requirement. 5.3 Explain operation of wood working machines. 5.4 Use furniture making tools 5.5 Operate machineries. 5.6 Perform wood working operations 5.7 Maintain tools, equipment and machineries.	**Unit - V Carpentry** 5.1 Types of artificial woods such as plywood, block board, hardboard, laminated boards, Veneer, fiber Boards and their applications. 5.2 Wood working hand tools carpentry vice, marking and measuring tools, saws, claw hammer, mallet, chisels, plans, squares, and their specifications 5.3 Wood working machineries – Wood turning lathe, circular saw, their specifications. 5.4 Basic process in carpentry shop marking, sawing, planning, chiseling, turning, grooving, boring. 5.5 Safety practices to be followed in carpentry shop 5.6 Preparation of wooden joints **Course Outcome : CO5 Practical Hours :10**

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Laboratory LearningOutcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	No. of hrs.	Relevant COs
1.1 Use fire extinguisher 1.2 Operate fire extinguisher	1	Identification of fire extinguishers and demonstration of extinguishing fire in a group of students	10	CO1

2.1 .Prepare site visit report 2.2 Perform lineout activity.	2	Prepare the report of site visit of a construction project with reference to substructure construction activities along with the equipment used. Perform the lineout activity on the site for the given type of foundation work.	16	CO2
3.1 Select proper plumbing tools 3.2 Use plumbing operations for Preparing plumbing joints.	3	Prepare T joint or Elbow joint pipe fitting job as per the drawing.	10	CO3
4.1 Select proper fitting tools 4.2 Prepare fitting job using different tools	4	Prepare male-female type fitting job as per the drawing involving operations like marking, punching, filing, sawing, drilling and taping.	10	CO4
5.1 Select proper carpentry tools 5.2 Prepare utility jobs/joints using different manufacturing processes.	5	Prepare utility job (like stool, benches, tables, dais or similar jobs) / carpentry joint using artificial wood/natural wood. Utility job may be preparation of new job or repairing of existing products.	10	CO5
6.1 Collect information about ancient tools for understanding Indian Knowledge.	6	Draw sketches of various ancient tools	04	CO5
		Total	**60**	

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning): NIL

VI. Specification Table: NOT APPLICABLE

VII. Assessment Methodologies/Tools

Formative assessment (Assessment for Learning)

Rubrics for continuous assessment based on process and product related performance indicators (10 marks)

Rubric Criterion	Max Marks	Not Satisfactory (1)*	Satisfactory (2)*	Good (3)*	Excellent (4)*
Ability to utilize the appropriate tools safely to perform various operations	04	Not able to select & utilize technically correct tools, safely to perform the operations	Able to select & utilize the tools safely to perform the operations but lacks preciseness in answer	Able to select & utilize the tools safely to perform the operations with understanding with	Able to select & utilize the tools safely to perform the operations with technical understanding &

				preciseness in answer but less application orientation	substantiating with applications & conclusions of experiments performed.
Quality and completion of job in prescribed time,	04	Not able to complete the job in stipulated time with desired quality, do not follow basic maintenance practices	Able to complete the job in stipulated time with desired quality but lacks in preciseness. Lacks in following basic maintenance practices	Able to complete the job in stipulated time with desired quality with but less application orientation. Follows improper basic maintenance practices	Able to complete the job in stipulated time with desired quality & substantiating with applications. Follows correct basic maintenance practices
Attendance	02				

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Summative Assessment (Assessment of term end examination)

End term Practical examination, (50 marks, 2 Hours duration)

Criterion No	Rubric Criterion	Max Marks (10)*	Not Satisfactory (1-4)*	Satisfactory (5-6)*	Good (7-8)*	Excellent (9-10)*
1	Ability to Select appropriate tools, work holding devices, & machineries.	10	Not able to select the tools and work holding devices technically correct	Able to select the tools and work holding devices with gross understanding but lacks preciseness in answer	Able to select the tools and work holding devices with understanding with preciseness in answer but less application orientation	Able to select the tools and work holding devices with technical understanding & substantiating with applications & conclusions of experiments performed. Effective communication/ presentation
2	Ability of process planning i.e. sequences of operations to be performed on job.	10	Not able to plan the process technically correct	Able to plan the process with gross understanding but lacks preciseness in answer	Able to plan the process with understanding with preciseness in answer but less application orientation	Able to plan the process with technical understanding & substantiating with applications & conclusions of experiments performed.
3	Use the tools, equipments safely to perform various operations on the job	10	Not able to utilize technically correct tools, safely to perform the operations	Able to utilize the tools safely to perform the operations but lacks preciseness in answer	Able to utilize the tools safely to perform the operations with understanding with preciseness in answer but less application orientation	Able to utilize the tools safely to perform the operations with technical understanding & substantiating with applications & conclusions of experiments performed.
4	Quality and completion of job in prescribed	10	Not able to complete the job in stipulated	Able to complete the job in stipulated time with desired quality but lacks in	Able to complete the job in stipulated time with desired quality with but less	Able to complete the job in stipulated time with desired quality & substantiating with applications

Criterion No	Rubric Criterion	Max Marks (10)*	Not Satisfactory (1-4)*	Satisfactory (5-6)*	Good (7-8)*	Excellent (9-10)*
	time as per the drawing /specification		time with desired quality	preciseness	application orientation	
5	Follow basic maintenance practices of related tools, equipment's, and machineries.	10	Not able to Follow basic maintenance practices of related tools, equipment's, and machineries	Able to Follow basic maintenance practices of related tools, equipment's, and machineries but lacks in preciseness	Able to Follow basic maintenance practices of related tools, equipment's, and machineries but less application orientation	Able to Follow basic maintenance practices of related tools, equipment's, and machineries properly.

Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO 1	PSO 2	PSO 3
CO1	3	-	-	3	3	2	2	-	3	3
CO2	3	-	-	3	2	3	2	3	3	-
CO3	3	-	-	3	2	3	2	-	2	3
CO4	3	1	1	3	2	3	2	-	1	1
CO5	3	-	-	3	2	3	2	-	1	1
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

VIII. Suggested Learning Materials / Books

Sr.No	Author	Title	Publisher
1	Bawa, H.S.	Workshop Practice	McGraw Hill Education, Noida; ISBN-10:0070671192 ISBN-13: 978-0070671195
2	Gupta, J.K.; Khurmi, R.S.	A Textbook of Manufacturing Process(Workshop Tech.)	S.Chand and Co. New Delhi ISBN:81-219-3092-8
3	Hegde, R.K.	Workshop Practice Manual For Engineering Diploma & ITI Students	Sapna Book House, 2012, ISBN:13: 9798128005830

4	Singh, Rajender	Introduction to Basic ManufacturingProcess & Workshop Technology	New Age International, New Delhi; 2014,ISBN: 978-81-224-3070-7
5	Hajra; Choudhary	Elements of Workshop Technology	Media Promoters and Publishers Mumbai,2009, ISBN: 10-8185099146
6	Sarathe, A.K	Engineering Workshop Practice	Khanna Book Publishing CO(P) LTD, NewDelhi, ISBN No. 978-93-91505-51-6

IX. Learning Websites & Portals

Sr.No	Link / Portal	Description
1	http://www.asnu.com.au	Basic engineering tools.
2	http://www.abmtools.com/downloads/Woodworking%20Carpentry%20Tools.pdf	Wood working
3	http://www.weldingtechnology.org	Welding techniques
4	http://www.newagepublishers.com/samplechapter/001469.pdf	Basic engineering tools.
5	http://www.youtube.com/watch?v=TeBX6cKKHWY	Welding techniques
6	http://www.youtube.com/watch?v=QHF0sNHnttw&feature=related	Welding techniques
7	http://www.youtube.com/watch?v=Kv1zo9CAxt4&feature=relmfu	Wood working
8	http://www.piehtoolco.com	Basic engineering tools.
9	http://sourcing.indiamart.com/engineering/articles/materials-used-hand-tools/	Basic engineering tools.
10	https://www.youtube.com/watch?v=9_cnkaAbtCM	Basic engineering tools.

X. Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1.	Dr. V. U. Rathod	LME, I/C Workshop Supdt.	Government Polytechnic, Mumbai
2.	Mr. U.A. Agnihotri	LME	Government Polytechnic, Mumbai
3.	Shri. A. S. Sangwikar	LME, I/C Workshop Supdt.	Government Polytechnic, Thane
4.	Dr. D.K.Gupta	HOD,Civil Dept .	Government Polytechnic, Mumbai

Coordinator,
Curriculum Development,
Department of Civil Engineering

Workshop Supdt.
Government Polytechnic, Mumbai

Head of Department
Department of Civil Engineering

I/C, Curriculum Development Cell

Principal

Programme : Diploma in CE/ME													
Course Code: AM 23101					**Course Title: ENGINEERING MECHANICS**								
Compulsory / Optional: Compulsory													
Learning Scheme and Credits						**Assessment Scheme**							
CL	**TL**	**LL**	**SLH**	**NLH**	**Credits**	**FA-TH**		**SA-TH (2 Hrs. 30min.)**	**FA-PR**	**SA**		**SLA**	**Total**
						TS1	**TS2**			**PR**	**OR**		
3	**-**	**2**	**1**	**6**	**3**	**20**	**20**	**60**	**25**	**-**	**-**	**25**	**150**

Total IKS Hrs. for course: 4

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
1. FA-TH represents two class tests of 20 Marks each conducted during the semester.
2. SA-TH represents the end term examination.

I. Rationale

In day to day life we come across different structures, at the time of design of structures, analysis plays an important role. Perfect analysis is possible only when one knows the types and effect of forces acting on the structure. This course provides knowledge about the different types of forces/loads, their effects while acting in different conditions/systems. The course also provides the knowledge about basic concepts of laws of engineering, their application to different engineering problem. The principles of mechanics are fundamental to Mechanical and Civil Engineering and related programs such as Mechatronic Engineering, Naval Architecture, Aerospace, Manufacturing as well as Biomedical engineering. This course is needed as a prerequisite for the courses at higher level such as Mechanics of Structures, Strength of Materials, Design of Structures, Theory of Machines, etc.

II. Industry / Employer Expected Outcome

This course is to be taught and implemented with the aim to develop in the student, the course outcomes (COs) leading to the attainment of industry identified outcome expected from this course and they can demonstrate the understanding of basic and fundamental concepts needed for design of machine elements as well as structures and beams.

III. Course Outcomes: Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Apply principles of simple machines
CO2	Determine unknown forces of various force system
CO3	Apply the principles of equilibrium to engineering problems.
CO4	Apply the principle of friction in various conditions.
CO5	Calculate centroid and centre of gravity for various geometrical figures.
CO6	Apply the principles of dynamics.

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO)	Topics / Sub-topics
1	**TLO 1.1** Describe Definitions of Simple & Compound Machines **TLO 1.2** Explain terminology related to machines and its various parameters such as MA,VR etc **TLO 1.3** Explain the Law of Machines and Reversibility of Machines **TLO 1.4** Describe and compute the Velocity Ratio and other parameters for Different Simple Machines	**Simple Machines:** 1.1 Definitions 1.2 Simple machine, compound machine , load , effort , mechanical advantage , velocity ratio , input of a machine ,output of a machine efficiency of a machine , ideal machine, ideal effort and ideal load, load lost in friction, effort lost in friction 1.3 Analysis: Law of machine, maximum mechanical advantage and maximum efficiency of a machine, reversibility of a machine, condition for reversibility of a machine, self-locking machine, simple numerical problems. 1.4 Velocity Ratio for simple machines : Simple axle and wheel, differential axle and wheel, Weston's differential pulley block, single purchase crab, double purchase crab, worm and worm wheel, geared pulley block, screw jack, calculation of mechanical advantage, efficiency, identification of type such as Reversible or not etc. **Course Outcome : CO1 Teaching Hours :6 hrs**

2	**TLO 2.1** Explain the basics of Statics, Forces & Force Systems **TLO 2.2** Explain the method of resolution of force **TLO 2.3** Explain algebraic method for determination of resultant force **TLO2.4** Describe the graphical method for finding the resultant of a force system.	**Force systems:** 2.1 Fundamentals and Force systems: Definitions engineering mechanics, statics, Dynamics. Classification of force system according to plane coplanar and non-coplanar, sub classification of coplanar force system- collinear, concurrent, non-concurrent, parallel, Definition of a force, representation of a force by vector and by Bow's notation method. Characteristics of a force, effects of a force, principle of transmissibility. 2.2 Resolution of a force and Moment of a force: Definition, Method of resolution, along mutually perpendicular direction and along two given direction. Definition of moment, classification of moments, sign convention, law of moments,Varignon's theorem of moment and it's use, definition of couple, properties of couple 2.3 Composition & resolution of forces : Definition of Resultant force, methods of composition of forces, Law of parallelogram of forces, Algebraic method for determination of resultant for various force system. 2.4 Graphical method: Space diagram, vector diagram, polar diagram, and funicular polygon. Resultant of concurrent and parallel force system only. **Course Outcome: CO2 Teaching Hours :10 hrs**
3	**TLO3.1** Explain the concept of Equilibrant force, Lami's Theorem **TLO3.2** Describe Beams and their types as well finding support reaction for different end supports	**Equilibrium:** 3.1 Equilibrant and Lami's Theorem: Definition of equilibrant, relation between resultant and equilibrant, equilibrant of concurrent and non-concurrent force system. Analytical, free body and free body diagram. Statement and explanation of Lami's theorem and Application. 3.2 Beams: Definition, Types of beams (cantilever, simply supported, overhanging, fixed, continuous), Types of end supports (simple support, hinged, roller), classification of loads, point load, inclined point load, uniformly distributed load. Analytical method to determine reactions of simply supported, cantilever and over hanging beam subjected to point loads and UDL and graphical method to determine reactions for beams subjected to vertical point loads &UDL only **Course Outcome: CO3 Teaching Hours :8 hrs**
4	**TLO4.1** Explain the concept of Friction and Coefficient of Friction **TLO4.2** Describe equilibrium of a body on horizontal & inclined plane as well as ladder friction **TLO4.3** Describe basic of Dynamic	**Friction:** 4.1 Definition: Friction, Types of friction, limiting frictional force, coefficient of friction, angle of friction, angle of repose, relation between angle of friction, angle of repose and coefficient of friction. Cone of friction, advantages and disadvantages of friction. 4.2 Equilibrium of body on Horizontal and inclined plane: Equilibrium of body on horizontal plane subjected to horizontal and inclined force. Equilibrium of body on inclined plane subjected to forces applied

	Friction	parallel to the plane only. Concept of ladder friction. 4.3 Introduction (only) -Dynamic friction **Course Outcome:CO4 Teaching Hours :8 hrs**
5	**TLO5.1** Explain & plot the Centroid for different geometrical sections **TLO5.2** Explain & plot the CG for different geometrical sections	**Centroid and Centre Of Gravity:** 5.1 Centroid: Definition of centroid. Moment of an area about an axis. Centroid of basic geometrical figures such as square, rectangle, triangle, circle, semicircle and quarter circle. Centroid of composite figure with not more than three geometrical figures. 5.2 Center of gravity: Definition, center of gravity of simple solids such as cylinder, sphere, hemisphere, cone, cube, and rectangular block. Centre of gravity of composite solids with not more than Two simple solids. (Hollow solids are expected.) **Course Outcome:CO5 Teaching Hours :8 hrs**
6	**TLO 6.1** Explain the kinetics and the different laws of motion **TLO 6.2** Explain the kinematics and the different laws of motion **TLO 6.3** Describe the concepts of Angular Motion, Displacement & Acceleration **TLO 6.4** Explain and analyse the different types of Motion under gravity.	**Dynamics :** 6.1 Kinetics: Definition of kinetics, Newton's laws of motion and its applications. 6.2 Kinematic: Definition of kinematics, Basic concepts of motion, rectilinear motion, displacement, velocity, speed, acceleration. 6.3 Angular motion : Introduction, definition of angular velocity, angular acceleration, angular displacement, (Simple Numericals) 6.4 Motion under gravity. (No numerical on this subtopic)

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Laboratory Learning Outcomes (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	**LLO 1.1** To determine MA, VR, Efficiency, & other experimental parameters for Differential axle & wheel and for Simple Screw jack.	To determine MA, VR, Efficiency, Ideal Effort, Effort lost in friction for Differential axle & wheel and for Simple screw jack.	2	CO1
2	**LLO2.1** To determine MA, VR,	To determine MA, VR, Efficiency, Ideal Effort, Effort lost in friction for single purchase crab and for double	2	CO1

	Efficiency, & other experimental parameters for single purchase crab and for double purchase crab.	purchase crab.		
3	**LLO 3.1** To experimentally verify Law of Polygon of Forces	Verify law of polygon of forces	2	CO2
4	**LLO 4.1** To Graphically determine resultant of concurrent and non-concurrent force system	Graphically determine resultant of concurrent and non-concurrent force system.	4	CO2
5	**LLO 5.1** To Graphically determine resultant of parallel force system.	Graphically determine resultant of parallel force system.	2	CO2
6	**LLO 6.1** To experimentally verify law of moments.	To verify law of moments.	2	CO2
7	**LLO 7.1** To experimentally verify Lami's theorem	To verify of Lami's theorem	2	CO3
8	**LLO 8.1** To experimentally verify the Equilibrium of parallel forces – simply supported beam reactions	To verify the Equilibrium of parallel forces – simply supported beam reactions	2	CO3
9	**LLO 9.1** To experimentally determine coefficient of friction for motion on horizontal plane.	To determine coefficient of friction for motion on horizontal plane.	4	CO4
10	**LLO 10.1** To find and plot the Centroid of basic geometrical figures	Determination of Centroid of basic geometrical figures such as square, rectangle, triangle, circle& Centre of gravity of simple solids such as cylinder, sphere, cone, cube.	4	CO5
11	**LLO 11.1** To find and plot the Centroid of basic geometrical figures	Numericals on Angular motion	4	CO6

Note: if any

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

Formative assessment (Assessment for Learning) for PR and SLA

- Rubrics for continuous assessment based on process and product related performance indicators(___ marks)

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (__marks)

a) Suggested COs - POs Matrix Form

CO vs PO and CO vs PSO Mapping (CIVIL ENGINEERING)

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO1 Basic and Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ develoment of solutions	PO4 Engineering Tools, Experimentation and Testing	PO5 Engineering practices for society, sustainability and environment	PO6 Project Management	PO7 Life-long learning	PSO1	PSO2	PSO3
CO1	3	3	3	2	1	2	2	3	2	--
CO2	3	3	3	2	1	1	2	3	--	--
CO3	3	3	3	2	1	1	2	3	--	--
CO4	3	3	3	2	1	1	2	3	--	--
CO5	3	3	3	2	1	1	2	3	--	--
CO6	3	3	3	2	1	1	2	3	--	--
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

CO vs PO and CO vs PSO Mapping (MECHANICAL ENGINEERING)

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)	
	PO1 Basic and Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ develoment of solutions	PO4 Engineering Tools, Experimentation and Testing	PO5 Engineering practices for society, sustainability and environment	PO6 Project Management	PO7 Life-long learning	PSO1	PSO2
CO1	3	3	3	2	1	2	2	3	2
CO2	3	3	3	2	1	1	2	3	3

CO3	3	3	3	2	1	1	2	3	3
CO4	3	3	3	2	1	1	2	3	3
CO5	3	3	3	2	1	1	2	3	3
CO6	3	3	3	2	1	1	2	3	3
Legends: - High:03, Medium:02, Low:01, No Mapping: --									

b) Suggested Learning Materials / Books

Sr.No	Author	Title	Publisher
1	R.S.Khurmi,	Engineering Mechanics 10-9352833961	S. Chand & Company Ltd.
2	Shames and Rao,	Engineering Mechanics 13-978-0133569087	Pearson Education.
3	R.C.Hibbeler,	Engineering Mechanics 13-978-0133073577	Pearson Education.
4	S. Ramamruthum,	Applied Mechanics 10-935216427X	Dhanpat Rai & Sons, Delhi.

c) Learning Websites & Portals

Sr.No	Link / Portal	Description
1	support@swayam.gov.in	-
2	arunasis@iitg.ernet.in	-
3	www.google.com	-
4	www.youtube.com	-
5	http://www.nationallibrary.gov.in	-

d) Academic Consultation Committee/Industry Consultation Committee:

Sr. No	Name	Designation	Institute/Organization
1	Shri Shivkumar Aade	Deputy Chief Engineer	Mhada
2	Shri Sharad Sonawane	Director	Om Ajay Constructions
3	Smt Supriya Patil	Lecturer in Civil Engineering	S.B.M.Polytechnic
4	Smt Sanjana Londhe	Lecturer in Civil Engineering	G.P.Mumbai
5	Shri Mangesh Jadhav	Lecturer in Applied Mechanics	G.P.Mumbai

Coordinator,
Curriculum Development,
Department of _____ Engineering

Head of Department
Department of _____ Engineering

I/C, Curriculum Development Cell

Principal

Programme : Diploma in CE													
Course Code: CE 23102					**Course Title SURVEYING I**								
Compulsory / Optional: Compulsory													
Learning Scheme and Credits						**Assessment Scheme**							
CL	**TL**	**LL**	**SLH**	**NLH**	**Credits**	**FA-TH**		**SA-TH (2Hrs. 30min.)**	**FA-PR**	**SA**		**SLA**	**Total**
						T1	**T2**			**PR**	**OR**		
3	**-**	**4**	**1**	**8**	**4**	**20**	**20**	**60**	**25**	**25#**	**-**	**25**	**175**

Total IKS Hrs. for course: 2

Abbreviations: CL- Class Room Learning, TL- Tutorial Learning, LL- Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, SLA- Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination, @$ Internal Online Examination

Note:
1. FA-TH represents marks of two class tests of 20 marks each conducted during the term.
2. SA-TH represents the end term examination.

I. Rationale

Development and planning process for any civil engineering project needs survey of that area to be carried out and various types of survey maps are to be prepared. These maps and drawing are used for taking various decisions regarding the planning, designing, estimation, execution and construction process. The diploma pass outs/technicians should therefore know the various methods and instruments required for surveying. They should also have the skill and information to handle and operate the needed survey instruments. This course is therefore one of the core courses required for Civil Engineers.

II. Industry / Employer Expected Outcome

Select a building/infrastructure project where right from starting to end, survey works needed to be taught and practiced.

III. Course Outcomes:

Students will be able to achieve & demonstrate the following COs on completion of course based learning

CO1	Select the type of survey required for given situation.
CO2	Compute area of open field using chain, tape and cross staff.
CO3	Conduct traversing in the field using chain and compass.
CO4	Use leveling instruments to determine reduced level of ground points.
CO5	Draw/interpret contour maps of an area collecting field data.

CO6	Use digital planimeter to calculate the areas.

Course Content Details:

Unit No.	Theory Learning Outcomes (TLO)	Topics / Sub-topics
1	**TLO1.1** Explain Object of Surveying, Purpose and Uses of Surveying **TLO1.2** Describe classification of surveying- Primary and Secondary classification **TLO 1.3** Explain principles of Survey	**Introduction** 1.1Defination of Surveying, Object of Surveying, Purpose and Uses of Surveying 1.2Classification of surveying- Primary and Secondary classification 1.3Principles of Survey **Course Outcome: CO1 , Teaching Hours : 4 hrs Marks: 04 (R-2, U-2, A- --)**
2	**TLO2.1** Explain the Principle of Chain Surveying, Well Conditioned and Ill-Conditioned Triangles **TLO2.2** Describe Instruments used in chain survey **TLO2.3** Explain Selection of survey station, Subsidiary station, Tie station, Base line, Check line, Tie line, Offset- Perpendicular and Oblique **TLO2.4** Explain Location Sketch of survey station and running measurements of building **TLO2.5** Explain Conventional symbols, recording of measurements in a field book. **TLO2.6** Explain Ranging: Direct Ranging and Indirect Ranging **TLO2.7** Explain the Chaining on level and sloping ground.	**Chain And Cross Staff Survey** 2.1 Principle of Chain Surveying, Well Conditioned and Ill-Conditioned Triangles 2.2 Instruments used in chain survey - Metric Chain, Tapes, Arrow, Ranging rod, Line ranger, Offset rod, Open cross staff, optical square Principle of optical square 2.3 Selection of survey station, Subsidiary station, Tie station, Base line, Check line, Tie line, Offset- Perpendicular and Oblique 2.4 Location Sketch of survey station and running measurements of building 2.5 Conventional symbols, recording of measurements in a field book. 2.6 Ranging: Direct Ranging and Indirect Ranging 2.7 Chaining on level and sloping ground. **Course Outcome: CO2 Teaching Hours : 08 Marks:10 (R-2 , U-4 , A- 4)**
3	**TLO3.1** Explain Principle of compass survey, Traversing **TLO3.2** Explain the Technical Terms **TLO3.3** Explain the Components of Prismatic Compass and their Functions, Method of using Prismatic Compass **TLO3.4** Explain the Local attraction, Methods of correction of observed bearings **TLO3.5** Explain the Methods of plotting a traverse and closing error	**Chain and Compass traverse Survey** 3.1 Principle of compass survey, Traversing- closed traverse, open traverse 3.2 Technical Terms: True, Magnetic and Arbitrary Meridians and Bearings, Fore Bearing and Back Bearing, Whole Circle Bearing System and Reduced Bearing System, Examples on conversion of WCB in to RB and vice versa, Calculation of internal and external angles from bearings at a station. Dip of Magnetic needle, Magnetic Declination. 3.3 Components of Prismatic Compass and their Functions, Method of using Prismatic Compass- temporary adjustments and observing bearings 3.4 Local attraction, Methods of correction of observed bearings-Correction at station and correction to included angles, 3.5 Methods of plotting a traverse and closing error, Graphical adjustment of closing error. **Course Outcome:CO3 Teaching Hours :12 Marks:14 (R- 4 , U- 6 , A-4)**

4	**TLO4.1** Explain/Describe Definitions **TLO4.2** Explain the Types of levels **TLO4.3** Types of Levelling **TLO4.4** Explain the Types of Levelling Staffs **TLO4.5** Explain the Reduction of level **TLO4.6** Explain the Numerical examples to find the R. L. **TLO4.7** Explain the Errors in Levelling	**Levelling** 4.1 Definitions: Levelling, Level surface, Level line, Horizontal plane, Horizontal line, Vertical line and vertical plane, Datum surface, Reduced Level, Line of collimation, Axis of telescope, Axis of bubble tube, Bench Marks- GTS, Permanent, Arbitrary and Temporary, Back sight, Fore sight, intermediate sight, Change point, Height of instruments . 4.2 Types of levels: Dumpy, Tilting, Auto level, Digital level, Components of Dumpy Level and its fundamental axes. Temporary adjustments of Dumpy and Auto Level. 4.3 Types of Levelling: Simple, Differential, Fly, Profile and Reciprocal Levelling 4.4 Types of Levelling Staffs: Self-reading staff and Target staff. 4.5 Reduction of level by Line of collimation method and Rise/ Fall Method 4.6 Numerical examples to find the R. L. by H.I.Method and Rise and Fall Method with necessary checks 4.7 Errors in Levelling **Course Outcome:CO4 Teaching Hours :12 Marks:16 (R- 4 , U- 6 , A- 06)**
5	**TLO5.1** Explain/Describe the Definitions **TLO5.2** Explain the Uses of contour maps, Characteristics of contours, methods of Contouring **TLO5.3** Explain the Interpolation of contours	**Contouring** **5.1** Definitions: Contour, contour interval, horizontal equivalent. 5.2 Uses of contour maps, Characteristics of contours, methods of Contouring: Direct and indirect 5.3 Interpolation of contours by Approximate method and Arithmetic method. **Course Outcome:CO5 Teaching Hours :6 Marks:10 (R- 2 , U- 4 , A- 4)**
6	**TLO6.1** Explain/Describe Components and use of Digital planimeter **TLO6.2** Explain the Measurement of area using digital planimeter **TLO6.3** Measurement of volume of reservoir from contour map	**Measurement of Area and Volume** 6.1 Components and use of Digital planimeter 6.2 Measurement of area using digital planimeter. 6.3 Measurement of volume of reservoir from contour map using digital planimeter. **Course Outcome: CO6 Teaching Hours :3 Marks: 06 (R- 2 , U- 4, A-)**

IV. Laboratory Learning Outcome and Aligned Practical / Tutorial Experiences.

Sr No	Laboratory Learning Outcomes (LLO)	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
1	**LLO 1.** Measurement of distance between two survey stations when two stations are inter visible	Measure distance between two survey stations using tape and ranging rods when two stations are inter visible	2	CO2
2	**LLO2.** Direct ranging and measurement of the distance between two stations	Undertake direct ranging and measure the distance between two stations	4	CO2

3	**LLO 3.** Determination of area of open field using chain & cross staff survey	Determine area of open field using chain & cross staff survey	6	CO2
4	**LLO 4.** Measurement of Fore Bearing and Back Bearing of open traverse using Prismatic Compass.	Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass.	6	CO3
5	**LLO 5.** Measurement of Fore Bearing and back bearing of a closed traverse	Measure Fore Bearing and back bearing of a closed traverse of 5or 6 sides and correct the bearings and included angles for the local attraction	8	CO3
6	**LLO 6.** Survey Project with chain and compass for closed traverse	Undertake Survey Project with chain and compass for closed traverse for minimum 5 sides (Compulsory)	1Full Day	CO3
7	**LLO 7.** Traverse on A1 size imperial drawing sheet for data collected in Survey Project	Plot the traverse on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical no.6	6	CO3
8	**LLO 8.** Simple leveling using dumpy level/ Auto level and leveling staff.	Undertake simple leveling using dumpy level/ Auto level and leveling staff.	4	CO4
9	**LLO 9.** Differential leveling and determine Reduced Levels	Undertake differential leveling and determine Reduced Levels by Height of Instrument method and Rise and Fall method using dumpy /auto level and leveling staff.	6	CO4
10	**LLO 10.1** Fly leveling with double check using dumpy / auto level and leveling staff.	Undertake fly leveling with double check using dumpy / auto level and leveling staff.	4	CO4
11	**LLO 11.** Survey Project with Leveling instrument for Profile leveling and cross-sectioning for a road	Undertake Survey Project with Leveling instrument for Profile leveling and cross-sectioning for a road length of 500 m with cross-section at 30 m interval. (Compulsory).	1 Full Day	CO4
12	**LLO 12.** L-section with minimum 3 cross-sections on A1 size imperial sheet for data collected in Survey Project	Plot the L-section with minimum 3 cross-sections on A1 size imperial sheet for data collected in Survey Project mentioned at practical no.11	6	CO4
13	**LLO 13.** Survey Project for plotting contour map using block contouring method	Undertake Survey Project for plotting contour map using block contouring method for a block of 150m x 150m with grid of 10m x 10m. (Compulsory)	1 Full Day	CO5
14	**LLO 14.** contours on A1 size imperial drawing sheet for data collected in Survey Project	Plot the contours on A1 size imperial drawing sheet for data collected in Survey Project mentioned at practical no.13	6	CO5
15	**LLO 15.** Measurement of area of irregular figure using Digital planimeter	Measure area of irregular figure using Digital planimeter.	2	CO6

V. Suggested Micro Project / Assignment/ Activities for Specific Learning / Skills Development (Self Learning):

1. **Experiment No. 6: Survey Project with chain and compass for closed traverse**

   Undertake Survey Project with chain and compass for closed traverse for minimum 5 sides (Compulsory) 1 Full day Project

2. **Experiment No. 11: Survey Project with Leveling instrument for Profile leveling and cross-sectioning for a road**

   Undertake Survey Project with Leveling instrument for Profile leveling and cross-sectioning for a road length of 500 m with cross-section at 30 m interval. (Compulsory). 1 Full Day Project

Formative assessment (Assessment for Learning) for PR and SLA

- Rubrics for continuous assessment based on process and product related performance indicators(___ marks)

Summative Assessment (Assessment of Learning)

End term examination, Viva-voce, Workshop performance (__marks)

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3. Suggested COs - POs Matrix Form

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	3	3	1	1	3	2	2	2	1
CO2	3	3	3	3	2	2	2	2	2	3
CO3	3	3	2	3	2	3	2	2	2	3
CO4	3	3	3	3	2	3	2	2	2	3
CO5	3	3	3	3	2	3	2	2	2	3
CO6	3	2	3	3	2	3	2	2	2	2
Legends: - High:03, Medium:02, Low:01, No Mapping: --										

4. Suggested Learning Materials / Books

Sr. No.	Title	Author, Publisher, Edition and Year Of publication	ISBN
1	Surveying and Levelling	N. N. Basak Tata McGraw Hill Education Private Ltd. New Delhi , 33rd reprint2010	ISBN 93-3290-153-8
2	Surveying and Levelling volume I	Kanetkar, T. P.; Kulkarni, S. V. Pune Vidyarthi Gruh Prakashan	ISBN 978-81-858-2511-3
3	Survey I	Duggal, S. K. McGraw Hill Education Private Ltd. New Delhi,	ISBN 978-00-701-5137-6
4	Surveying I	Punmia B.C., Jain Ashok Kumar; Jain Arun Kumar Laxmi Publications., New Delhi.	ISBN: 8-17-008853-4

5. Learning Websites & Portals

Sr.No	Link / Portal	Description
1	http://www.asnu.com.au	
2	www.oupinheonline.com	
3	http://www.mtu.edu/technology/undergrad	
4	http://www.wb.psu.edu/Academics/Degrees	
5	http://www.tjc.edu/info/2004134/profess	
6	http://www.pstcc.edu/catalog/12-13/cerp	
7	https://youtu.be/e_yabRh5GY	
8	https://youtu.be/Z4yYHHX8N0	
9	https://youtu.be/2hL4wWUUSFc	
10	https://youtu.be/j8poe2vvD2Q	
11	https://youtu.be/chhuq_t40rY	
12	https://youtu.be/L54T4uvpMTg	
13	https://youtu.be/NdNEy-HBsoA	
14	https://youtu.be/7dN3Iku0Bns	

6. Academic Consultation Committee/Industry Consultation Committee:

Sr.	Name	Designation	Institute/Organization

No			
1	Shri. S D Borkar	Deputy Engineer	PWD
2	Shri. Sudhir Nimbalkar	Assistant Engineer	BMC
3	Mr. K.V. Kelgandre	Sr. Lecturer in Civil Engg.	K.J. Somaiya Polytechnic
4	Dr D K Gupta	HOD in Civil Engg.	Govt. Polytechnic Mumbai

Coordinator,
Curriculum Development,
Department of _____ Engineering

Head of Department
Department of _____ Engineering

I/C, Curriculum Development Cell

Principal