Maharashtra State Board Of Technical Education, Mumbai

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name	**: Diploma In Civil Engineering / Civil & Rural Engineering / Construction Technology / Civil & Environmental Engineering**		
Programme Code	**: CE / CR / CS / LE**	**With Effect From Academic Year**	**: 2023-24**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 16 WEEKS**
Semester	**: Second** **NCrF Entry Level : 3.0**	**Scheme**	**: K**

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme												
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																	Practical						
						CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
													Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
(All Compulsory)																								
1	APPLIED MATHEMATICS	AMS	AEC	312301	2	3	1	-	-	4	2	3	30	70	100	40	-	-	-	-	-	-	100
2	APPLIED SCIENCE – APPLIED PHYSICS	ASC	DSC	312308	4	2	-	2	0	8	4	1.5	30	70*#	100	40	25	10	25@	10	-	-	200
	APPLIED SCIENCE – APPLIED CHEMISTY					2	-	2	0								25	10	25@	10			
3	ENGINEERING MECHANICS	EGM	DSC	312312	2	3	1	2	2	8	4	3	30	70	100	40	25	10	-	-	25	10	150
4	BUILDING MATERIAL AND CONSTRUCTION	BMC	DSC	312338	1	3	-	2	3	8	4	3	30	70	100	40	25	10	-	-	25	10	150
5	SURVEYING	SUY	SEC	312339	1	3		4	1	8	4	3	30	70	100	40	25	10	50#	20	25	10	200
6	PROFESSIONAL COMMUNICATION	PCO	SEC	312002	0	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50
7	SOCIAL AND LIFE SKILLS	SFS	VEC	312003		-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50
Total					**10**	**16**	**2**	**14**	**8**	**40**	**20**		**150**	**350**	**500**		**150**		**125**		**125**		**900**

Abbreviations : CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

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

Note :

1. FA-TH represents average of two class tests of 30 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 SLA of 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.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

Course Category : Discipline Specific Course Core (DSC) : 3, Discipline Specific Elective (DSE) : 0, Value Education Course (VEC) : 1, Intern./Apprenti./Project./Community (INP) : 0, AbilityEnhancement Course (AEC) : 1, Skill Enhancement Course (SEC) : 2, GenericElective (GE) : 0

♦ For the course Applied Science - candidate will have to appear for pre-examination of both physics & chemistry. If absent in any one section (physics / chemistry) student will be declared as absent & fail for the course and marks will not be processed or carried forward.

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Textile Technology/ Electronics & Computer Engg./ Textile Manufactures**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ FC/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ MU/ PG/ PN/ PO/ TC/ TE/ TX**
Semester	**: First**
Course Title	**: BASIC MATHEMATICS**
Course Code	**: 311302**

I. RATIONALE

Basic Mathematics plays a crucial role in diploma programmes as it fosters the development of critical thinking skills, enhances quantitative literacy, prepares students for higher education, promotes problem-solving abilities, cultivates logical and abstract thinking and fosters mathematical literacy. By engaging with Mathematics, students acquire logical reasoning, problem-solving techniques and analytical thinking, which are valuable for lifelong learning and professional growth. Calculus is a branch of Mathematics that calculates how matter, particles and heavenly bodies actually move. Derivatives are useful to find maxima and minima of the function, velocity and acceleration are also useful for many engineering optimization problems. Statistics can be

defined as a type of mathematical analysis which involves the method of collecting and analyzing data and then summing up the data into a numerical form for a given set of factual data or real-world observations. It equips individuals with the ability to interpret numerical information, make informed decisions and navigate real-world situations. Moreover, Mathematics provides a foundation for further studies in various disciplines and prepares students to tackle complex challenges. By exploring abstract concepts and logical structures, students develop their ability to reason, make connections, and approach problems with clarity and precision. Furthermore, studying Mathematics helps students appreciate the historical and cultural significance of Mathematics and its applications in diverse fields, thereby fostering mathematical literacy and a deeper understanding of the world. Hence the course provides the insight to analyze engineering problems scientifically using logarithms, matrices, trigonometry, straight line, differential calculus and statistics. By incorporating these topics, students comprehend to approach engineering problems from a mathematical perspective, enabling them to devise efficient and effective solutions and this leads to preparing Diploma graduates well-rounded, adaptable and capable of making significant contributions to the branch-specific problems.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply the concept of Mathematics to solve industry-based technology problems.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Apply the concepts of algebra to solve engineering (discipline) related problems.
- CO2 - Utilize trigonometry to solve branch specific engineering problems.
- CO3 - Solve area specific engineering problems under given conditions of straight lines.
- CO4 - Apply differential calculus to solve discipline specific problems.
- CO5 - Use techniques and methods of statistics to crack discipline specific problems.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
311302	BASIC MATHEMATICS	BMS	AEC	4	2	-	2	8	4	3	30	70	100	40	-	-	-	-	25	10	125

Total IKS Hrs for Sem. : 6 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, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 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 SLA of 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.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Solve the given simple problem based on laws of logarithm. TLO 1.2 Solve given system of linear equations using matrix inversion method. TLO 1.3 Obtain the proper and improper partial fraction for the given simple rational function. TLO 1.4 Solve simultaneous equations by using concept given in Ancient Indian Mathematics.	**Unit - I Algebra** 1.1 Logarithm: Concept and laws of logarithm. 1.2 Matrices: Matrices, algebra of matrices, transpose, value of determinant of matrix of order 3x3, adjoint and inverse of matrices. 1.3 Matrices: Solution of simultaneous equations by matrix inversion method. 1.4 Partial Fractions: Types of partial fraction based on nature of factors and related Problems. 1.5 Algebra in Indian Knowledge System: Solution of simultaneous equations (Indian Mathematics)..	Improved Lecture Tutorial Assignment Demonstration Simulation
2	TLO 2.1 Apply the concept of Compound angle, allied angle and multiple angles to solve the given simple engineering problem(s). TLO 2.2 Apply the concept of Sub- multiple angle to solve the given simple engineering related problem(s). TLO 2.3 Apply concept of factorization and de-factorization formulae to solve the given simple engineering problem(s). TLO 2.4 Investigate given simple problems by utilizing inverse trigonometric ratios. TLO 2.5 Use concept given in Ancient Indian Mathematics for trigonometry to solve given problems.	**Unit - II Trigonometry** 2.1 Trigonometric ratios of allied angles, compound angles, multiple angles (2A, 3A), submultiples angles. (without proof) 2.2 Factorization and De factorization formulae. (without proof). 2.3 Inverse Trigonometric Ratios and related problems. 2.4 Principle values and relation between trigonometric and inverse trigonometric ratios. 2.5 Trigonometry in Indian Knowledge System: The Evolution of Sine Function in India. 2.6 Indian Trigonometry: Basic Indian Trigonometry- Introduction and Terminology (From Ancient Beginnings to Nilakantha). 2.7 Trigonometry in Indian Knowledge System: Pythagorean triples in Sulabasutras.	Improved Lecture Tutorial Assignment Demonstration Simulation Flipped Classroom approach

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Calculate angle between given two straight lines. TLO 3.2 Formulate equation of straight lines related to given engineering problems. TLO 3.3 Identify perpendicular distance from the given point to the line. TLO 3.4 Calculate perpendicular distance between the given two parallel lines. TLO 3.5 Use geometry given in Sulabasutras to solve the given problems.	**Unit - III Straight Line** 3.1 Straight line and slope of straight line: Angle between two lines, Condition of parallel and perpendicular lines. 3.2 Various forms of straight lines: Slope point form, two-point form, Double intercept form, General form. 3.3 Perpendicular distance from a point on the line. 3.4 Perpendicular distance between two parallel lines. 3.5 Geometry in Sulabasutras in Indian Knowledge System (construction of square, circling the square). (Indian Mathematics).	Improved Lecture Tutorial Assignment Demonstration Simulation
4	TLO 4.1 Solve the given simple problems based on functions. TLO 4.2 Solve the given simple problems based on rules of differentiation. TLO 4.3 Obtain the derivatives of composite, implicit, parametric, inverse, logarithmic, exponential functions. TLO 4.4 Apply the concept of differentiation to find given equation of tangent and normal. TLO 4.5 Apply the concept of differentiation to calculate maxima, minima and radius of curvature for given function. TLO 4.6 Familiar with concept of calculus given in Indian Mathematics.	**Unit - IV Differential Calculus** 4.1 Functions and Limits: Concept of function and simple examples. 4.2 Functions and Limits: Concept of limits without examples. 4.3 Derivatives: Rules of derivatives such as sum, Product, Quotient of functions. 4.4 Derivatives: Derivative of composite functions (chain Rule), implicit and parametric functions. 4.5 Derivatives: Derivatives of inverse, logarithmic and exponential functions. 4.6 Applications of derivative: Second order derivative without examples, Equation of tangent and normal, Maxima and minima, Radius of curvature. 4.7 Calculus in Indian Knowledge System: The Discovery of Calculus by Indian Astronomers. (Indian Mathematics).	Improved Lecture Tutorial Assignment Demonstration Simulation

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Obtain the range and coefficient of range of the given grouped and ungrouped data. TLO 5.2 Calculate mean and standard deviation of ungrouped and grouped data related to the given simple engineering problem(s). TLO 5.3 Determine the variance and coefficient of variance of given grouped and ungrouped data. TLO 5.4 Justify the consistency of given simple sets of data.	**Unit - V Statistics** 5.1 Range, coefficient of range of discrete and grouped data. 5.2 Mean deviation and standard deviation from mean of grouped and ungrouped data. 5.3 Variance and coefficient of variance. 5.4 Comparison of two sets of observation.	Improved Lecture Tutorial Assignment Demonstration Simulation Flipped Classroom approach

VI. 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
LLO 1.1 Solve simple problems of Logarithms based on given applications.	1	Solve simple problems of Logarithms based on given applications.	2	CO1
LLO 2.1 Solve elementary problems on Algebra of matrices for branch specific engineering related applications.	2	Solve elementary problems on Algebra of matrices for branch specific engineering related applications.	2	CO1
LLO 3.1 Apply the concept of matrix to solve engineering problems.	3	Solve solution of Simultaneous Equation using inversion method.	2	CO1
LLO 4.1 Apply the concept of matrix to solve engineering problems.	4	Apply Matrix Inversion method to determine currents through various branches of given electrical networks.	2	CO1
LLO 5.1 Apply the concept of matrix to solve engineering problems.	5	Determine inverse of a non-singular matrix by using open source software.	2	CO1
LLO 6.1 Apply the concept of partial fraction to solve engineering problems.	6	Resolve into partial fraction using linear non-repeated, repeated, and irreducible quadratic factors.	2	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 7.1 Solve problems on Compound, Allied, multiple and sub multiple angles for related shapes.	7	Solve problems on Compound, Allied, multiple and sub multiple angles for related shapes.	2	CO2
LLO 8.1 Utilize the concept of trigonometry to solve engineering problems.	8	Practice problems on factorization and de factorization.	2	CO2
LLO 9.1 Utilize the concept of trigonometry to solve engineering problems.	9	Solve problems on inverse trigonometric ratios based on applications.	2	CO2
LLO 10.1 Solve branch specific engineering problems under given conditions of straight lines.	10	Practice problems on equation of straight lines using different forms.	2	CO3
LLO 11.1 Solve branch specific engineering problems under given conditions of straight lines.	11	Solve problems on perpendicular distance, distance between two parallel lines and angle between two lines.	2	CO3
LLO 12.1 Solve branch specific engineering problems under given conditions of straight lines.	12	Use given form of straight line to calculate the speed, distance and time of moving object.	2	CO3
LLO 13.1 Apply the concept of derivative to solve engineering problems.	13	Solve problems to find derivatives of implicit function and parametric function.	2	CO4
LLO 14.1 Apply the concept of derivative to solve engineering problems.	14	Solve problems to find derivative of logarithmic and exponential functions for engineering applications.	2	CO4
LLO 15.1 Apply the concept of equation of tangent and normal to solve engineering problems.	15	Solve problems based on finding equation of tangent and normal for engineering applications.	2	CO4
LLO 16.1 Apply the concept of maxima, minima and radius of curvature to solve engineering problems.	16	Solve problems based on finding maxima, minima of function and radius of curvature at a given point for engineering applications.	2	CO4
LLO 17.1 Apply the concept of equation of tangent and normal to solve engineering problems.	17	Use the concept of tangent and normal to solve the given problem of Engineering Drawing.	2	CO4
LLO 18.1 Apply the concept of Maxima and Minima to solve engineering problems.	18	Use the concept of Maxima and Minima to obtain optimum value for given engineering problem.	2	CO4

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 19.1 Apply the concept of radius of curvature to solve engineering problems.	19	Use the concept of radius of curvature to solve given branch specific engineering problem.	2	CO4
LLO 20.1 Utilize the concept of derivative to solve engineering problems.	20	Use the concept of derivative to find the slope of a bending curve for given engineering problem.	2	CO4
LLO 21.1 Use concept of range and mean deviation to crack branch specific problems.	21	Solve problems on finding range, coefficient of range and mean deviation for given applications.	2	CO5
LLO 22.1 Use concept of standard deviation and coefficient of variance to crack branch specific problems.	22	Solve problems on standard deviation, coefficient of variation and comparison of two sets.	2	CO5
LLO 23.1 Use concept of standard deviation to crack branch specific problems.	23	Calculate the Standard Deviation for Concrete with the given data for given engineering applications.	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Create a function that takes a matrix as input and returns its inverse matrix if it exists. Also Implement a program that finds the inverse of a square matrix.
- Collect the Data of Marks obtained by your class in mid sem test. Compute the variance and coefficient of variance of the data and interpret the result using the free open source software ORANGE.
- Prepare models using matrices to solve simple problems based on cryptography.
- Collect Model on quality control analysis, energy efficiency assessment, environmental monitoring, and process optimization, for these models, analyze data and calculate variance and standard deviation, make a presentation including short videos.
- Prepare the model using the concept of tangent and normal bending of roads in case of sliding of a vehicle, express geometrically the same through any open source software.

- Prepare the model using the concept of radius of curvature to bending of railway tracks, express geometrically the same through any open source software.
- A window in the form of a rectangle surmounted by a semicircular opening. The total perimeter of the window to admit maximum light through the whole opening, prepare a model using concept of Maxima and Minima for the above problem and verify the result.
- Visualize trigonometric waveforms and create animations utilizing sine or cosine functions and make a presentation.
- Develop a program of trigonometric function calculator that computes sine, cosine, and tangent values.
- Collect applications of the radius of curvature on lens design and optics, mirror and reflective surface properties, road and highway design, structural behavior, roller coaster track design, and composite material manufacturing and make a video of 5-minutes duration.
- Prepare models using trigonometry based on at least 10 engineering problems.
- Apply trigonometric principles to calculate angles, distances, forces, and dimensions relevant to the chosen area and make a poster presentation.
- Prepare charts using determinant to find area of regular shapes.
- Design a puzzle based on matrices. Create a grid of numbers and operations.
- Develop a math game based on operations of matrices.
- Use matrices as a tool for music composition. Assign different musical elements (e.g., notes, chords, rhythms) to matrix elements, and experiment with combining and transforming the matrices to create unique musical compositions. You can use musical notation open software or even traditional instruments to bring your compositions to life.
- Attempt any 10-12 Micro Projects, out of the given list.

Assignment

- Collect examples based on real world applications of logarithm and prepare a pdf file.
- Solve the simultaneous system of equation in two variables by Matrix Inversion Method. Write down a Mathematical programming using any open source software to verify the result.
- Collect an examples on coding theory using applications of matrices and prepare a pdf file.
- Represent the Graph of Trigonometric function, Logarithmic function on Geogebra and interpret the nature of graph and Make a pdf file.
- Measure height of trees in surrounding locations using trigonometry and prepare presentation.
- Find the derivative of y= x^sinx and visualize the graph of the function and its derivative using any open source software geometrically.
- Find height of room or distance between two pillars by using concept of straight line.
- Collect at least 10 examples based on real world applications of standard deviation/variance.
- Collect at least 10 examples based on real world uses of applications of derivative.
- Attempt any 5-7 Assignment, out of the given list.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Open-source software like SageMaths, MATHS3D, GeoGebra, Graph, DPLOT, and Graphing Calculator (Graph Eq 2.13), ORANGE can be used for Algebra, Calculus, Trigonometry, and Statistics respectively.	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Algebra	CO1	12	2	6	6	14
2	II	Trigonometry	CO2	16	2	6	6	14
3	III	Straight Line	CO3	6	2	2	4	8
4	IV	Differential Calculus	CO4	16	2	8	10	20
5	V	Statistics	CO5	10	2	6	6	14
Grand Total				**60**	**10**	**28**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Tests
- Rubrics for COs Assignment
- Midterm Exam
- Self-learning
- Term Work
- Seminar/Presentation

Summative Assessment (Assessment of Learning)

- End Term Exam
- Micro-project
- Tutorial Performance

XI. 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	1	-	1	-	1	1			
CO2	3	1	-	-	1	1	1			
CO3	3	-	-	-	-	-	-			
CO4	3	1	1	1	-	1	-			
CO5	3	2	1	1	1	1	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Grewal B. S.	Higher Engineering Mathematics	Khanna publication New Delhi , 2013 ISBN: 8174091955
2	Dutta. D	A text book of Engineering Mathematics	New age publication New Delhi, 2006 ISBN: 978-81-224-1689-3
3	Kreysizg, Ervin	Advance Engineering Mathematics	Wiley publication New Delhi 2016 ISBN: 978-81-265-5423-2
4	Das H.K.	Advance Engineering Mathematics	S Chand publication New Delhi 2008 ISBN: 9788121903455

Sr.No	Author	Title	Publisher with ISBN Number
5	Marvin L. Bittinger David J. Ellenbogen Scott A. Surgent	Calculus and Its Applications	Addison-Wesley 10th Edition ISBN-13: 978-0-321-69433-1
6	C. S. Seshadri	Studies in the History of Indian Mathematics	Hindustan Book Agency, New Delhi 110016. ISBN 978-93-80250-06-9
7	George Gheverghese Joseph	Indian Mathematics Engaging with the World from Ancient to Modern Times	World Scientific Publishing Europe Ltd. 57 ISBN 978-17-86340-61-0
8	Deepak Singh	Mathematics-I	Khanna Book Publishing Co. (P) Ltd. ISBN: 978-93-91505-42-4
9	Garima Singh	Mathematics-II	Khanna Book Publishing Co. (P) Ltd. ISBN: 978-93-91505-52-3
10	Gareth James, Daniela Witten, Trevor Hastie Robert and Tibshirani	An Introduction to Statistical Learning with Applications in R	Springer New York Heidelberg Dordrecht London ISBN 978-1-4614-7137-0 ISBN 978-1-4614-7138-7 (eBook)
11	Gunakar Muley	Sansar Ke Mahan Ganitagya	First Edition, Rajkamal Prakashan, ISBN-10. 8126703571, ISBN-13. 978-8126703579.
12	T.S. Bhanumurthy	A Modern introduction to Ancient Indian Mathematics	New Age International Private Limited, 1 January 2008 ISBN- 10. 812242600X, ISBN- 13. 978-8122426007
13	M.P. Trivedi and P.Y. Trivedi	Consider Dimension and Replace Pi	Notion Press; 1st edition (2018), ISBN-978-1644291795

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	http://nptel.ac.in/courses/106102064/1	Online Learning Initiatives by IITs and IISc
2	www.scilab.org/ -SCI Lab	Signal processing, statistical analysis, image enhancement.
3	www.mathworks.com/product/matlab/ -MATLAB	Applications of concepts of Mathematics to coding.
4	Spreadsheet Applications	Use of Microsoft Excel, Apple Numbers, Google Sheets.
5	https://ocw.mit.edu/	MIT Course ware

Sr.No	Link / Portal	Description
6	https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHoPig	Concept of Mathematics through video lectures and notes
7	http://ocw.abu.edu.ng/courses/mathematics/	List of Mathematical Courses.
8	https://libguides.furman.edu/oer/subject/mathematics	Open Education Resources (OER) in Mathematics.
9	https://phet.colorado.edu/en/simulations/filter?subjects=math&type=html,prototype	Phet Simulation for Mathematics.
10	https://libguides.cmich.edu/OER/mathematics	Mathematics with OER.

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Textile Technology/ Electronics & Computer Engg./ Textile Manufactures**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ FC/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ MU/ PG/ PN/ PO/ TC/ TE/ TX**
Semester	**: First**
Course Title	**: BASIC SCIENCE**
Course Code	**: 311305**

I. RATIONALE

Diploma engineers have to deal with various materials and machines. This course is designed with fundamental information to help the diploma engineering students to apply the basic concepts and principles of physics and chemistry to solve broad- based engineering problems. The basic concepts and principles of sciences related to heat, electricity, magnetism, optics, semiconductors, engineering materials will help in understanding the technology courses where emphasis is on the applications of these in various technology domain applications

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 following industry identified outcome expected from this course: Apply principles of physics and chemistry to solve broad based relevant engineering problems.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Use basic instruments to measure the physical quantities in various engineering situations.
- CO2 - Apply the basic principles of electromagnetics to solve given engineering problems.
- CO3 - Apply basic principles of thermometry and fibre optics to solve engineering problems.
- CO4 - Predict the structure, properties and behaviour of molecules and compounds based on the types of chemical bond.
- CO5 - Apply the concepts of electrochemistry and corrosion preventive measures in industry.
- CO6 - Use the appropriate engineering material and catalyst appropriately.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
311305	BASIC SCIENCE	BSC	DSC	4	-	4	2	10	5	1.5	30	70*#	100	40	50	20	50@	20	50	20	250

Total IKS Hrs for Sem. : 4 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, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 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 SLA of 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.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

♦ Candidate remaining absent in practical examination of any one part of Basic Science course i.e. Physics,Chemistry will be declare as Absent in Mark List and has to appear for examination. The marks of the part for which candidate was present will not be processed or carried forward.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain physical quantities and its types with examples. TLO 1.2 Differentiate between scalar and vector quantities with examples. TLO 1.3 Apply dimensional analysis to check correctness of equation and conversion of units in different systems . TLO 1.4 Estimate the errors in the measurement for the give problem. TLO 1.5 Explain the working of ancient astronomical instruments to measure distance , time and hour angle . TLO 1.6 Explain the procedure of measuring the dimension of a given object by using vernier calipers and screw gauge .	**Unit - I Units and Measurements** 1.1 Unit, physical quantities: fundamental and derived quantities and their units Systems of units: CGS, MKS and SI . 1.2 Scalar and Vector Physical Quantities. 1.3 Dimensions, dimensional formula ,Applications of dimensional analysis; correctness of physical equations ,conversion factor for interconversion of units in different systems of units. 1.4 Errors, types of errors: instrumental, systematic and random error, estimation of errors: absolute, relative and percentage error, significant figures. 1.5 Ancient astronomical instruments:Chakra, Dhanuryatra , Yasti and Phalaka yantra . 1.6 Applications of Vernier calipers , Screw gauge .	Chalk and board Improved lecture, Tutorial Assignment Demonstration

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Explain electric field, potential and potential difference. TLO 2.2 Explain magnetic intensity and flux with their units. TLO 2.3 Apply laws of series and parallel combination to the given electrical circuits.Explain the heating effect of electric current. TLO 2.4 Distinguish between conductors, semiconductors and insulators on the basis of energy bands. TLO 2.5 Explain the I-V characteristics and applications of p-n junction diode.	**Unit - II Electricity, Magnetism and Semiconductors** 2.1 Concept of charge, Coulomb's inverse square law, Electric field, Electric field intensity, potential and potential difference. 2.2 Magnetic field and magnetic field intensity and its units, magnetic lines of force, magnetic flux . 2.3 Electric current, Ohm's law, specific resistance, laws of series and parallel combination of resistance, conversion of galvanometer into ammeter and voltmeter, Heating effect of electric current . 2.4 Conductors, Insulators and Semiconductors, Energy bands, intrinsic and extrinsic semiconductors, minority and majority charge carriers. 2.5 p-n junction diode, Depletion layer I-V characteristics of p-n junction, static and dynamic resistance, applications of p-n junction diode ,: Half wave rectifier.	Chalk and board Improved lecture, Tutorial Assignment Demonstration Educational Games

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Convert temperature in different temperature scales. TLO 3.2 Compare different modes of heat transfer with examples. TLO 3.3 Inter-relate the characteristics of the three gas laws. TLO 3.4 Inter-relate the characteristics of the three gas laws. TLO 3.5 Explain total internal reflection in optical fiber. TLO 3.6 Differentiate between types optical fibber with applications.	**Unit - III Thermometry and Fiber Optics** 3.1 Heat, temperature, temperature scale: Degree Celsius, degree Kelvin, degree Fahrenheit. 3.2 Modes of heat transfer: Conduction , Convection and Radiation , Applications in daily life . 3.3 Boyle's law, Charle's law, Gay Lussac's law, perfect gas statements equations and simple numerical. 3.4 Law of thermal conductivity ,Newton's law of cooling. 3.5 Law of refraction, total internal reflection. 3.6 Optical fibber: Principle, construction and working Types of Optical fibers;Single mode step index, Multimode step index, Multimode graded index Applications of optical fibers.	Chalk and board Improved lecture, Tutorial Assignment Demonstration Flip classroom Educational Games
4	TLO 4.1 Explain the properties of given material based on the bond formation. TLO 4.2 Describe the molecular structure of given solid, liquid and gases. TLO 4.3 Describe the crystal structure of the given solids. TLO 4.4 Explain Properties of metallic solid.	**Unit - IV Chemical bonding** 4.1 Indian Chemistry:-Philosophy of atom by Acharya Kanad. 4.2 Electronic theory of valency: Assumptions , Chemical bonds: Types and characteristics of electrovalent bond, covalent bond, coordinate bond, hydrogen bond, metallic bond and Intermolecular forces of attraction. 4.3 Molecular arrangement in solid, liquid and gases. 4.4 Structure of solids: crystalline and amorphous solids ,Properties of metallic solid, Unit cell: simple cubic, body center cubic (BCC) , face centre cubic (FCC), hexagonal close pack crystals.	Simulation, Model Display, Demonstration Chalk and board , PPT, ect

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Describe mechanism of electrolysis of CuSO4 solution by using cu and pt rods TLO 5.2 Solve numerical based on Faraday's first and second law of electrolysis. TLO 5.3 Distinguish between primary and secondary cell TLO 5.4 Describe the phenomenon of the given type of corrosion and its prevention. TLO 5.5 Identify the different factors affecting rate of corrosion for the given type of material. TLO 5.6 Select the protective measures to prevent the corrosion in the given corrosive medium.	**Unit - V Electro chemistry and Metal Corrosion, its prevent ion** 5.1 Electrolyte- Types of electrolyte, ionization and dissociation ,Cathode, Anode, Electrode potential: oxidation and reduction, Mechanism of electrolysis :Electrolysis, Electrochemical series for cations and anions. Mechanism of electrolysis of CuSO4 solution 5.2 Faraday's laws of electrolysis: Faraday's first and second law, relation between electrochemical equivalent and chemical equivalent, Numerical. Applications of electrolysis: Electro-refining of copper and Electroplating. 5.3 Difference between primary and secondary cell. 5.4 Corrosion: Definition and Types of corrosion Dry corrosion: Mechanism, Types of oxide film, Wet corrosion :Mechanism hydrogen evolution in acidic medium, oxygen absorption in neutral or alkaline medium ,Galvanic cell action by Daniel cell. 5.5 Factors affecting the rate of corrosion. 5.6 Corrosion control: Modification of environment, Use of protective coatings, coating of less active metal like Tin (Tinning), coating of more active metal like Zinc (Galvanizing), Anodic and cathodic protection, Choice of material-using pure metal and using metal alloy	Simulation, Demonstration, Flipped Classroom, Collaborative Learning, Case Study, On-site/Industrial Visit ,chalk and board etc.

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
6	TLO 6.1 Identify the ingredients of the given paints. TLO 6.2 List out salient properties of the given paint and varnish. TLO 6.3 Describe the properties of insulating materials for the given application. TLO 6.4 Differentiate the given types of structural polymers. TLO 6.5 Describe the polymerization process of the given polymer. TLO 6.6 Explain the properties and uses of the given polymer, elastomer and adhesive. TLO 6.7 Describe the application of relevant adhesives required for the given material. TLO 6.8 Suggest the lubricant for various types of machines in industry. TLO 6.9 Select the relevant catalyst for given application.	**Unit - VI Engineering Materials and Catalysis** 6.1 Paints: Purposes of applying paint, Characteristics of paints, Ingredients of paints, Function and examples of each ingredient. 6.2 Varnish: Types, Difference between paint and varnishes. 6.3 Insulators: Characteristics, Classification,Properties and Application of Glass wool Thermocol. 6.4 Polymer and Monomer : Classification on the basis of Molecular structure, on the basis of monomers (homo polymer and copolymer), on the basis of Thermal behavior(Thermoplastics and Thermosetting). 6.5 Types Polymerization Reaction, Addition Polymerization, Condensation Polymerization, Synthesis, properties and application of Polyethylene, Polyvinyl chloride, Teflon, Polystyrene, Phenol formaldehyde, Epoxy Resin. 6.6 Adhesives: Characteristics, Classification and their uses 6.7 Lubricants: Classification, properties and Applications. 6.8 Catalysis: Types of catalysis homocatalysis ,heterocatalysis . 6.9 Catalyst: Types of Catalyst Positive, Negative and Auto-catalyst, Catalytic Promoter and Catalytic inhibitor, Industrial application of catalyst.	Simulation, Demonstration, On-site Visit ,Chalk and Board, etc.

VI. 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

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Use Vernier caliper to : Measure dimensions of given objects. Measure the dimensions of objects of known dimensions. LLO 1.2 Estimate the errors in measurement.	1	Measurements of dimensions of given object by Vernier caliper.	2	CO1
LLO 2.1 Use Micrometer Screw gauge to: Measure dimensions of given objects. Measure the dimensions of objects of known dimensions. LLO 2.2 Estimate the errors in measurement.	2	Measurements of dimensions of given objects by micrometer screw gauge.	2	CO1
LLO 3.1 Apply Ohm's law to solve circuit problems.	3	Determination of resistance by Ohm's law.	2	CO2
LLO 4.1 Determine the specific resistance of given wire.	4	Determination of specific resistance of given wire.	2	CO2
LLO 5.1 Verify law of series connection of resistors.	5	Determination of equivalent resistance in series connection of resistors.	2	CO2
LLO 6.1 Verify law of parallel connection of resistors.	6	Determination of equivalent resistance in parallel connection of resistors.	2	CO2
LLO 7.1 Use magnetic compass to draw the magnetic lines of forces of magnet of different shapes and determine neutral points.	7	Determination of neutral points by magnetic compass.	2	CO2
LLO 8.1 Use P -N junction diode to draw forward bias and reverse bias I-V characteristics LLO 8.2 Find out static and dynamic resistance of given P N junction diode	8	Determination of static and dynamic resistance of given P N junction diode.	2	CO2
LLO 9.1 Determine forbidden energy band gap in semiconductors	9	Determination of forbidden energy band gap in semiconductors.	2	CO2
LLO 10.1 Use Joule's calorimeter to determine Joule's mechanical equivalent of heat	10	Determination of Joule's mechanical equivalent of heat by Joule's law.	2	CO3
LLO 11.1 Determine the pressure-volume relation using Boyle's law	11	Determination of pressure-volume relation using Boyle's law.	2	CO3
LLO 12.1 Use Newton"s law of cooling to determine the rate of heat loss due to convection phenomena	12	Determination of the rate of heat loss due to convection by Newton's law of cooling.	2	CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 13.1 Use Searle's thermal conductivity apparatus to find coefficient of thermal conductivity of given material (Virtual Lab)	13	Determination of Coefficient of thermal conductivity.	2	CO3
LLO 14.1 Determine the refractive index of glass slab using TIR phenomenon.	14	Determination of the refractive index of glass slab.	2	CO3
LLO 15.1 Determine the Numerical Aperture (NA) of a given step index optical fibre	15	Determination of the Numerical Aperture (NA) of a given step index optical fiber.	2	CO3
LLO 16.1 Identify cation in given ionic solutions by performing selective test	16	Identification of cation in given ionic solutions.	2	CO4
LLO 17.1 Identify anion in given ionic solutions by performing selective test	17	Identification of anion in given ionic solutions.	2	CO4
LLO 18.1 Identify states of matter of materials by using simulation. by Appling heating and cooling Techniques. LLO 18.2 Relate temperature-pressure diagram	18	Identification of states of matter.	2	CO4
LLO 19.1 Determine the electrode potential of copper metal. by setting Electrochemical Cell LLO 19.2 Measure electrode potential of Cu Using Voltmeter. LLO 19.3 Measure the cell potential for various conditions.	19	Determination of electrode potential of copper.	2	CO5
LLO 20.1 Determine the electrode potential of Iron metal. by setting Electrochemical Cell LLO 20.2 Measure electrode potential of Fe Using Voltmeter LLO 20.3 Measure the cell potential for various conditions.	20	Determination of electrode potential of Iron metal.	2	CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 21.1 Determine the voltage generated from chemical reaction using Daniel Cell. LLO 21.2 Set up Daniel Cell. Prepare Electrolyte Solution LLO 21.3 Measure voltage accurately	21	Determination of the voltage generated from chemical reaction using Daniel Cell.	2	CO5
LLO 22.1 Prepare Electrolyte Solution of CuSO 4 of known concentration LLO 22.2 Set up electrolysis apparatus LLO 22.3 Control various parameters of electrolysis. LLO 22.4 Determine electrochemical equivalent of Cu metal using Faraday's first law.	22	Determination of electrochemical equivalent of Cu metal using Faraday's first law.	2	CO5
LLO 23.1 Prepare Electrolyte Solution of the given metal of known concentration LLO 23.2 Set up electrolysis apparatus LLO 23.3 Control various parameters of electrolysis LLO 23.4 Analyze the data obtained from the experiment. LLO 23.5 Verify Faraday second law	23	Determination of equivalent weight of metal using Faraday's second law.	2	CO5
LLO 24.1 Prepare corrosive solutions LLO 24.2 Determine the extent of corrosion.	24	Preparation of corrosive medium for Aluminium at different temperature.	2	CO5
LLO 25.1 Prepare corrosive solutions. LLO 25.2 Determine the extent of corrosion LLO 25.3 Compare the corrosion behaviour of Aluminum at different temperatures.	25	Determination of rate of corrosion at different temperatures for Aluminium.	2	CO5
LLO 26.1 Determine the effect of temperature on viscosity for given lubricating oil using Redwood viscometer-	26	Determination of effect of temperature on viscosity for given lubricating oil using Redwood viscometer-I.	2	CO6
LLO 27.1 Determine the steam emulsification number of given lubricating oil. LLO 27.2 Measure the steam flow duration	27	Determination of the steam emulsification number of given lubricating oil.	2	CO6

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 28.1 Calculate the flash and fire point of given lubricating oils using Cleveland open cup apparatus	28	Determination of flash and fire point of given lubricating oils using Cleveland open cup apparatus.	2	CO6
LLO 29.1 Determine the flash point of given lubricating oil using Abel's closed cup apparatus.	29	Determination of flash point of given lubricating oil using Abel's closed cup apparatus.	2	CO6
LLO 30.1 Determine thinner content in oil paint. using electric oven	30	Determination of thinner content in oil paint.	2	CO6

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Series and parallel resistances: Prepare models for combination of series and parallel resistances.
- Magnetic flux: Prepare models to demonstrate magnetic lines of lines of forces of different types of magnet.
- Vernier Calipers: Prepare prototype vernier caliper of desired least.count using card sheet.
- Conductivity: Collect different materials such as metal, plastics, glass etc. and prepare models.
- Gas laws: Prepare models to demonstrate Boyle's laws, Charle's Law and Gay Lussac's law using household objects.
- Carbon resistors: Determine the resistance and tolerance of carbon resistors using color codes and measure values.
- Thermal conductivity: Take different metallic plates of various metals and calculate rate of flow of heat.
- Temperature sensor : Use Temperature sensor IC LM 35 to measure temperature of given body in various temperature scales
- Mobile applications : Use mobile applications for measurements of different physical quantities.
- Optical Fiber and TIR: Prepare model to demonstrate total internal reflection and the propagation of light.
- Convert given galvanometer into ammeter of desired range.
- Convert given galvanometer into voltmeter of desired range.
- LDR: Use Light dependent resistor for measuring the intensity of light.

- Types of bonds: Prepare chart and models displaying different types of bonds with examples.
- Prepare a chart for showing different types of bonds or molecules.
- Crystal Structure: Prepare Models of SC,FCC,HCP,BCC.
- Ionization: Prepare chart displaying ionization phenomenon.
- Corrosion-Prepare Chart displaying images of observed corrosion processes in the surrounding.
- Adhesives: Prepare chart or model to demonstrate the applications of various adhesives.
- Polymer: Collect the samples of different polymers and list their uses.
- Collect information based on market survey of different Polymer and compare the following points. i) Structure ii) Properties.
- Collect information by library survey regarding engineering material used in various industries.

Assignment

- Convert the units of a given physical quantity from one system of units to another.
- Measure room temperature of hot baths / bodies by using mercury thermometer and convert it into different scales.
- Prepare a chart to summarize units and measurements
- Enlist information like band gap, material used, dimension etc about different semiconductor devices.
- Give details about the explanation of concept like electrostatics, magnetic domain, current electricity.
- Demonstrate the variation of angle of refraction with respect to refractive index using online tools.
- Use a digital vernier caliper and micrometer screw gauge for measurements.(lab- based).
- Applications of optical fibers in civil, mechanical , electrical engineering etc.
- Applications of semiconductors in civil, mechanical , electrical engineering etc.
- Explain covalent bond, ionic bond, coordinate bond, hydrogen bond, intermolecular forces
- Draw Crystal structures of SC,BCC, FCC,HCP.
- Distinguish between paints and varnishes.
- Solve numerical based on Faraday’s first and second law of electrolysis.
- Enlist various Adhesives with properties and applications.
- Compare between Thermoplastics and Thermosetting.
- State properties and applications thermocol and glass wool.
- Differentiate the given types of structural polymers and list out their applications.
- Demonstrate Mechanism of wet corrosion by waterline corrosion.
- Prepare chart showing mechanism of electrolysis of $CuSO_4$ solution by using Cu and Pt electrodes.
- Write properties and applications of solid, semisolid and liquid lubricant.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Vernier Calipers: Range : 0-150mm , Resolution: 0.1mm	1
2	Micrometer screw gauge : Range : 0-25mm, Resolution: 0.01mm, Accuracy ±0.02mm or better	2
3	Digital multimeter : 3 1/2 digit display, 9999 counts, digital multimeter measures: Vac, Vdc (1000V max) , DC A, AC A(10 amp max), Resistance (0 - 100 MOhm	3,4,5,6
4	Resistance Box: 4 decade ranges from 1 ohm to 1K,accuracy 0.1 % - 1 %	3,4,5,6
5	Battery eliminator : 0- 12 V ,2A	3,4,5,6,8,9,10,12
6	Boyle's apparatus: U tube manometer , barometer	11
7	Joule's calorimeter : well insulated "mechanical equivalent of heat apparatus" in wooden box, , digital / analog thermometer,	10,12
8	Electronic balance, with the scale range of 0.001g to 500gm pan size 100 mm; response time 3-5 sec.: power requirement 90-250 V, 10 watt	19,20,21,22,23,24,25,30
9	Electric oven inner size 18''x18''x18''; temperature range 100 to 2500 C. with the capacity of 40 lt.	30
10	Ammeter 0-2 amp voltmeter-0-5v DC	19,20,21,22,23
11	Redwood viscometer-I	26
12	Cleveland open cup apparatus	28
13	Abel's close cup apparatus	29

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Units and Measurements	CO1	7	2	3	4	9
2	II	Electricity, Magnetism and Semiconductors	CO2	13	3	5	6	14
3	III	Thermometry and Fiber Optics	CO3	10	2	4	6	12
4	IV	Chemical bonding	CO4	6	2	3	4	9
5	V	Electro chemistry and Metal Corrosion, its prevent ion	CO5	12	3	4	5	12
6	VI	Engineering Materials and Catalysis	CO6	12	3	5	6	14
Grand Total				**60**	**15**	**24**	**31**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two unit tests of 30 marks (Physics 15 marks,Chemistry-15 marks) and average of two unit tests.
- For laboratory learning 50 marks (Physics 25 marks,Chemistry-25 marks).

Summative Assessment (Assessment of Learning)

- End semester assessment of 50 marks for laboratory learning (Physics 25 marks,Chemistry-25 marks).
- End semester assessment of 70 marks through online MCQ examination.

XI. 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	1		2	1	1	1			
CO2	3	1	1	2	1	1	1			
CO3	3	1	1	2	1	1	1			
CO4	3	2			2		1			
CO5	3	2	1	1	2		1			
CO6	3	2			2	1	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Narlikar J. V. ;Joshi , A. W.; Mathur , Anuradha ; et al	Physics Textbook Part I - Class XI	National Council of Education Research and Training, New Delhi, 2010, ISBN : 8174505083
2	Narlikar, J.V.;Joshi , A. W.; Mathur , Anuradha ; et al	Physics Textbook Part II - Class XI	National Council of Education Research and Training, New Delhi, 2015, ISBN : 8174505660
3	Narlikar J.V.;Joshi , A. W.; Ghatak A.K. et al	Physics Textbook Part I - Class XII	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506314
4	Narlikar, J.V.;Joshi , A. W.; Ghatak A.K. et al	Physics Textbook Part II - Class XII	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506713
5	Haliday, David; Resnik, Robert and Walker, Jearl	Fundamentals of Physics	John Wiley & sons, Hoboken, USA, 2014 ISBN : 812650823X
6	Jain and Jain	Engineering Chemistry	National Council of Education Research and Training, New Delhi, 2010, ISBN : 8174505083
7	Dara S. S.	Engineering Chemistry	National Council of Education Research and Training, New Delhi, 2015, ISBN : 8174505660
8	Bagotsky V.S.	Fundamental of electrochemistry	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506314
9	Jain and Jain	Engineering Chemistry	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506713
10	Aryabhatta.	The Surya Siddhanta	Baptist Mission press ,Calcutta

Sr.No	Author	Title	Publisher with ISBN Number
11	Steeramula Rajeswara Sarma	The Archaic And The Exotic : Studies In The History Of Indian Astronomical Instruments	Published by Manohar Book Service, 2008 ISBN 10: 8173045712 / ISBN 13: 9788173045714
12	Anju Rawlley,Devdatta V. Saraf	Applied Chemistry with Lab Manual	Khanna Book Publishing Co. (P) Ltd. New Delhi, 2021, ISBN- 978-93-91505-44-8
13	Dr. Hussain Jeevakhan	Applied Physics - II	Khanna Book Publishing, (2021), ISBN: 978-93-91505-57-8

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	www.sciencejoywagon.com/physicszone	Electricity, Magnetism and Semiconductors , basic of fiber optics
2	https://phet.colorado.edu	Electricity, Magnetism and Semiconductors ,Thermometry and basic of fiber optics
3	www.physicsclassroom.com	concepts of basic physics
4	http://nptel.ac.in/course.php?disciplineId=104	concepts of basic physics
5	http://hperphysics.phy-astr.gsu.edu/hbase/hph.html	concepts of basic physics
6	https://www.youtube.com/results?search_query=amruta+university+physics+expts	concepts of basic physics
7	k. https://www.youtube.com/results?search_query=physics+class+11+chapter+1	concepts of basic physics
8	l. https://www.youtube.com/watch?v=zRGh9_a1J7s	concepts of basic physics
9	https://iksindia.org	IKS physics
10	www.chem1.com	Chemistry instruction and education
11	ww.onlinelibrary.wiley.com	Materials and corrosion
12	www.rsc.org	Catalysis
13	www.chemcollective.org	Virtual Labs, simulation

Sr.No	Link / Portal	Description
14	https://www.ancient-origins.net/history-famous-people/indian -sage-acharya-kanad-001399	IKS Philosophy of atom by Acharya Kanad.
15	https://phet.colorado.edu/en/simulations/filter?subjects=che mistry&type=html,prototype	Identify states of matter of materials by using simulation.

Programme Name/s	**: Automobile Engineering./ Agricultural Engineering/ Civil Engineering/ Chemical Engineering/ Civil & Rural Engineering/ Construction Technology/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Production Engineering**
Programme Code	**: AE/ AL/ CE/ CH/ CR/ CS/ LE/ ME/ MK/ PG**
Semester	**: Second**
Course Title	**: ENGINEERING MECHANICS**
Course Code	**: 312312**

I. RATIONALE

The analysis of forces acting on various structural and machine elements using principles of mechanics gives useful data for detailing and design of structure and machine. The analysis of forces helps to prevent arises of defects, errors and subsequent failures in such elements under action of forces. This course is designed for diploma aspirants to acquire and apply the basic and discipline knowledge to solve practical problems regarding design and automation components in the field of various engineering disciplines such as civil, mechanical, agricultural etc. their allied disciplines.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply the principles of engineering mechanics to analyze, design and automation the prototypes and equipment's of various industries.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Select the suitable machine under given loading condition.
- CO2 - Analyze the given force system to calculate resultant force.
- CO3 - Determine unknown force(s) of given load combinations in the given situation.
- CO4 - Apply the laws of friction in the given situation.
- CO5 - Determine the centroid/centre of gravity of the given structural elements of having specific shape and size.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme										
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical					
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312312	ENGINEERING MECHANICS	EGM	DSC	3	1	2	2	8	4	3	30	70	100	40	25	10	-	-	25	10	150

Total IKS Hrs for Sem. : 2 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, IKS - Indian Knowledge System, SLA - Self Learning Assessment

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

Note :

1. FA-TH represents average of two class tests of 30 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 SLA of 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.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Identify the type of machine based on efficiency of machine. TLO 1.2 Calculate effort required and load lifted by the given simple lifting machine. TLO 1.3 Verify law machine for given loading. TLO 1.4 Determine effort required along with efficiency for given machine with varying velocity ratio.	**Unit - I Simple Lifting Machine** 1.1 Concept of simple lifting machine, load, effort, mechanical advantage, velocity ratio, efficiency of machines, reversible and non-reversible/self locking machines. (IKS*: Hand axe as wedge, Lever in battle, Inclined Plane for loading, Pulleys to lift water in irrigation) 1.2 Concept of ideal machine and its conditions, machine friction, ideal effort, ideal load, effort lost in friction and load lost in friction, maximum mechanical advantage and maximum efficiency. 1.3 Nature of graphs: Load vs. effort, load vs. ideal effort, load vs. MA, load vs. efficiency, Law of machine and its uses. 1.4 Velocity ratios of inclined plane, Differential axle and wheel, Worm and worm wheel, Single purchase and double purchase crab winch, Simple screw jack, Weston's differential pulley block, geared pulley block, two sheave pulley block, three sheave pulley block.	Chalk-Board Video Demonstrations Presentations Demonstration Hands-on Case Study

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Describe the characteristics of force. TLO 2.2 Calculate the moment of given forces in a force system. TLO 2.3 Suggest the suitable law for the analysis of given force system. TLO 2.4 Determine the components of given force. TLO 2.5 Calculate the resultant force of given force system analytically. TLO 2.6 Calculate the resultant force of given force system graphically.	**Unit - II Analysis of Forces** 2.1 Introduction of Mechanics: Engineering Mechanics, Statics, Dynamics, Kinetics, Kinematics, concept of rigid body, Force: definition, unit, graphical representation, Bow's notation, characteristics,Types of force system 2.2 Moment of force: Definition, unit, sign conventions, couple and its properties. 2.3 Law related to forces: Law of transmissibility of force, Law of polygon of forces, Varignon's theorem of moments, Law of moment, Law of parallelogram of forces. (IKS*:Weighing scale in Mohenjodaro, Harappa) 2.4 Resolution of coplanar forces: orthogonal and non orthogonal components of a force. 2.5 Composition of coplanar forces using analytical method. Resultant of collinear, concurrent and non-concurrent force system. 2.6 Composition of coplanar forces using graphical method. Resultant of concurrent force system and parallel force system consisting of maximum four forces only.	Chalk-Board Video Demonstrations Collaborative learning Presentations Hands-on Case Study

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Draw the Free Body Diagram for given loading in given situation. TLO 3.2 Determine the equilibrant of the given concurrent force system. TLO 3.3 Use Lami's theorem to determine the unknown forces causing equilibrium for given practical situation. TLO 3.4 Identify the type of beam in a given structure. TLO 3.5 Determine reactions in the given type of beam analytically.	**Unit - III Equilibrium of Forces** 3.1 Equilibrium and its conditions. 3.2 Equilibrant and relation with resultant, Equilibrant of concurrent force system. 3.3 Lami's Theorem and its applications, Concept of Free body diagram, (Problems unknown not more than two.) 3.4 Types of supports: fixed, simple, hinged, roller and fixed, Types of beams: cantilever, simply supported, overhanging, continuous and fixed. Types of loads: vertical and inclined point load, uniformly distributed load. 3.5 Determination of Beam reactions using analytical method for cantilever simply supported and overhanging beam subjected to vertical load, inclined load and uniformly distributed load (combination of any two types).	Chalk-Board Video Demonstrations Presentations Site/Industry Visit Hands-on Case Study
4	TLO 4.1 Determine friction force along with coefficient of friction for the given condition. TLO 4.2 Describe the conditions for friction for the give situation. TLO 4.3 Determine friction force in the given situation. TLO 4.4 Draw free body diagram for showing forces acting on a ladder under given condition.	**Unit - IV Friction of Forces** 4.1 Friction and its relevance in engineering, types and laws of friction, limiting equilibrium, limiting friction, co-efficient of friction, angle of friction, angle of repose, and their relationship. 4.2 Equilibrium of bodies on level surface subjected to force parallel to plane and inclined to plane. 4.3 Equilibrium of bodies on inclined plane subjected to force parallel to the plane only. 4.4 Forces acting on ladder (only free body diagram, no numerical).	Chalk-Board Video Demonstrations Presentations Demonstration Case Study Hands-on

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Determine the centroid of given plane figure. TLO 5.2 Determine the centroid of given composite figure. TLO 5.3 Determine center of gravity of given solid. TLO 5.4 Determine Centre of gravity of the given composite solid.	**Unit - V Centroid and Centre of Gravity** 5.1 Centroid of geometrical plane figures: square, rectangle, triangle, circle, semi-circle, quarter circle (IKS*: Archery arrowheads in Ramayana, Arch in archeological structures such as Mahal, Gol Gumbaz). 5.2 Centroid of composite figures such as I, L, C, T, Z sections (not more than three simple figures). 5.3 Centre of Gravity of simple solids: cube, cuboid, cylinder, cone, sphere and hemisphere (no hollow solids). 5.4 Centre of Gravity of composite solids composed of not more than two simple solids.	Chalk-Board Demonstration Video Demonstrations Model Demonstration Hands-on Case Study

VI. 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
LLO 1.1 Verify law of machine under the given condition. LLO 1.2 Verify law of moment of forces. LLO 1.3 Understand the centroid of structural component.	1	Collect the photographic information of Indian Knowledge System (IKS) given in various units.	2	CO1 CO2 CO5
LLO 2.1 Verify law of machine under the given condition.	2	*Determine mechanical advantage and velocity ratio of differential axle and wheel for different load and efforts.	2	CO1
LLO 3.1 Verify law of machine under the given condition.	3	Determine mechanical advantage and velocity ratio of worm and worm wheel for different load and efforts.	2	CO1
LLO 4.1 Verify law of machine under the given condition.	4	Determine mechanical advantage and velocity ratio of single purchase crab winch for different load and efforts.	2	CO1
LLO 5.1 Verify law of machine under the given condition.	5	Determine mechanical advantage and velocity ratio of double purchase crab winch for different load and efforts.	2	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 6.1 Verify law of machine under the given condition.	6	*Determine mechanical advantage and velocity ratio of simple screw jack for different load and efforts.	2	CO1
LLO 7.1 Verify law of machine under the given condition.	7	Determine mechanical advantage and velocity ratio of Weston's differential pulley block for different load and efforts.	2	CO1
LLO 8.1 Verify law of machine under the given condition.	8	Determine mechanical advantage and velocity ratio of geared pulley block for different load and efforts.	2	CO1
LLO 9.1 Verify law of machine under the given condition.	9	Determine mechanical advantage and velocity ratio of two sheave pulley block for different load and efforts.	2	CO1
LLO 10.1 Verify law of machine under the given condition.	10	Determine mechanical advantage and velocity ratio of three sheave pulley block for different load and efforts.	2	CO1
LLO 11.1 Analyse the resultant force of given force system.	11	*Verify law of polygon of forces using Universal force table for given forces.	2	CO2
LLO 12.1 Analyse the resultant force of given force system.	12	*Verify law of moment of forces using law of moment apparatus for given forces.	2	CO2
LLO 13.1 Analyse the resultant force of given force system.	13	Verify Varignon's theorem of moments of forces using law of moment apparatus for given forces.	2	CO2
LLO 14.1 Analyse the resultant force of given force system.	14	Determine graphically the resultant force of given concurrent force system.	2	CO2
LLO 15.1 Analyse the given force system acting on structural element.	15	Determine graphically the resultant force of given parallel force system.	2	CO2
LLO 16.1 Verify laws of friction related to forces.	16	*Verify the Lamis theorem using Universal force table apparatus for given forces.	2	CO3
LLO 17.1 Verify laws of friction related to forces.	17	*Determine support reactions of simply supported beam using parallel force or beam reaction apparatus for given vertical forces.	2	CO3
LLO 18.1 Apply the concept of centroid for given objects.	18	*Determine coefficient of friction using friction apparatus for given block on horizontal plane.	2	CO4
LLO 19.1 Verify laws of friction related to forces.	19	Determine coefficient of friction using friction apparatus for given block on inclined plane.	2	CO4

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 20.1 Apply the concept of centroid for given objects.	20	*Verify centroid of plane figure of given dimensions by making simple paper model.	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- Solve the examples on calculation of values of MA, VR, ?, Pi, Pf, Wi, Wf etc. for given type of machine.
- Solve the examples on calculation of centroid of simple/composite plane figures from given problem statement or figure.
- Solve the examples on calculation of centroid of simple/composite plane figures from given problem statement or figure.
- Solve the examples on calculation of centroid of simple/composite solid bodies from given problem statement or figure.
- Solve the examples on calculation of coefficient of friction, normal reaction, force required to pull the block for given case of frictional bodies (horizontal or inclined plane).
- Solve the examples on calculation of unknown forces using Lamis theorem from given problem statement or figure.
- Solve the examples on calculation of support reactions of given beam from given problem statement or figure.
- Solve the examples on calculation of orthogonal or non orthogonal components of a force.
- Solve the examples on calculation of resultant of a force for given force system from given problem statement or figure.
- Solve the examples on calculation of moments of a force from given problem statement or figure.

Micro project

- Prepare a chart showing comparison of centroid and center of gravity for square-cube, rectangle-cylinder, triangle-cone, circle-sphere, semicircle-hemisphere.
- Prepare chart of types of forces showing real-life examples.
- Prepare chart or flex of laws related to engineering mechanics like law of moment, law of machine, law of parallelogram of forces, Varignon’s theorem of moments etc..

- Collect photographs of specific simple lifting machine and relate these machines with the machines being studied and prepare models of simple lifting machines using tools in “MECHANO” and “MECHANIX”
- Prepare chart showing all types of beams having types of support (roller, hinged, fixed) with sketches and corresponding photographs of real life examples.
- Prepare models of types of beam subjected to all loads (point load, udl, uvl, moment, couple) with sketches and corresponding photographs of real life examples.
- Prepare photographic chart showing real life examples of uses of friction on horizontal (walking, writing, etc.) and inclined plane (slider in gardens, loading of heavy material in trucks etc.).

Note :

Note: Student should maintain a separate full size book to solve the assignment given by course teacher. Course teacher can assign following type of assignments to students. Assignments should be solved by individual students and corrective actions should be given by course teacher. These are the just suggestive microproject topics. Faculty must design microproject/activities/assignments based on course outcome requirements. Student should prepare 10-15 pages microproject on any topic in a group of 4 students only. Course teacher can allot following topics to microproject group. Microproject report should be prepared with new information other than classroom teaching. The necessary guidance for the microproject work should be provided by course teacher.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Simple axle and wheel (wall mounted unit with the wheel of 40 cm diameter and axles are insteps of 20 cm and 10 cm reducing diameter .	1
2	Differential axle and wheel (wall mounted unit with the wheel of 40 cm diameter and axles are insteps of 20 cm and 10 cm reducing diameter .	2
3	Worm and worm wheel (wall mounted unit with threaded spindle, load drum, effort wheel; with necessary slotted weights, hanger and thread)	3
4	Single Purchase Crab winch (Table mounted heavy cast iron body. The effort wheel is of C.I. material of 25 cm diameter mounted on a shaft of about 40mm dia. On the same shaft a geared wheel of 15 cm dia.	4
5	Double Purchase Crab winch (Having assembly same as above but with double set of gearing arrangement.)	5
6	Simple screw Jack (Table mounted metallic body , screw with a pitch of 5 mm carrying a double flanged turn table of 20 cm diameter.	6

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
7	Weston's Differential pulley block (consisting of two pulleys; one bigger and other smaller.	7
8	Weston's Differential worm geared pulley block (Consists of a metallic (preferably steel) cogged wheel of about 20 cm along with a protruded load drum of 10 cm dia. to suspend the weights of 10 kg, 20 kg-2 weights and a 50 kg weights)	8
9	Universal Force Table (Consists of a circular 40 cm dia. Aluminum disc, graduated into 360 degrees.) with all accessories.	9,14
10	Law of moment's apparatus consisting of a stainless steel graduated beam 12.5 mm square in section, 1m long, pivoted at centre.	10,11
11	Beam Reaction apparatus (The apparatus is with two circular dial type 10 kg.)	15
12	Friction apparatus for motion along horizontal and inclined plane (base to which a sector with graduated arc and vertical scale is provided. The plane may be clamped at any angle up to 45 degrees. pan. Two weight boxes (each of 5 gm,10 gm, 2-20 gm, 2-50 gm, 2-100 gm weight)	16,17
13	Models of geometrical figures.	18

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Simple Lifting Machine	CO1	9	2	8	4	14
2	II	Analysis of Forces	CO2	13	2	4	12	18
3	III	Equilibrium of Forces	CO3	9	2	8	4	14
4	IV	Friction of Forces	CO4	7	2	4	6	12
5	V	Centroid and Centre of Gravity	CO5	7	2	4	6	12
Grand Total				**45**	**10**	**28**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Term work (Lab Manual), Self-Learning (Assignment) Question and Answers in class room, quiz and group discussion. Note: Each practical will be assessed considering-60% weightage to process related and 40 % weightage to product related.

Summative Assessment (Assessment of Learning)

- Practical Examination, Oral Examination, Pen and Paper Test.

XI. 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	1	1	1	2	1	-	1			
CO2	2	2	1	2	1	-	1			
CO3	2	2	1	2	1	-	1			
CO4	2	2	2	2	1	-	1			
CO5	2	2	1	2	1	-	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	S. Ramamrutham	Engineering Mechanics	Dhanpat Rai Publishing Co. 2016 ISBN-13: 978-9352164271
2	R. S. Khurmi, N.Khurmi	Engineering Mechanics	S.Chand & Co. New Delhi 2018 ISBN: 978-9352833962
3	S. S. Bhavikatti	Engineering Mechanics	New Age International Private Limited ISBN: 978-9388818698
4	D. S. Bedi, M. P. Poonia	Engineering Mechanics	Khanna Publishing ISBN-13:978-9386173263
5	Dr. R. K. Bansal	Engineering Mechanics	Laxmi Publications ISBN 13: 9788131804094

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.engineersrail.com/simple-lifting-machine/	Introduction of simple lifting machine
2	https://www.youtube.com/watch?v=kNypk8GReqM	Law of machine and types of machines useful in industry.
3	http://nitttrc.edu.in/nptel/courses/video/112106286/L01.html	Introduction to engineering mechanics
4	https://www.youtube.com/watch?v=6u_rjLjv-MY&list=PLOSWwFV98r fKXq2KBphJz95rao7q8PpwT&index=3	Introduction of force system with examples
5	https://www.youtube.com/watch?v=Fudcc0JoXdo&list=PLOSWwFV98r fKXq2KBphJz95rao7q8PpwT&index=4	Resolution and composition of forces
6	https://www.youtube.com/watch?v=RrVuSbCZH8c	Verification of Lamis theorem in laboratory
7	https://www.youtube.com/watch?v=tM5hsUiNpGA	Calculation of beam reactions for various types of beams
8	https://www.youtube.com/watch?v=RGT1g_lu440	Calculation of coefficient of friction for horizontal and inclined plane
9	https://www.youtube.com/watch?v=wfjLNSfPXAI	Centroid of plane/composite figures, C.G. of plane/composite solids
10	https://www.youtube.com/watch?v=v6VTMwxx4oA	Centroid of composite figures.

Programme Name/s	**: Civil Engineering/ Civil & Rural Engineering/ Construction Technology/ Civil & Environmental Engineering/**
Programme Code	**: CE/ CR/ CS/ LE**
Semester	**: Second**
Course Title	**: BUILDING MATERIAL AND CONSTRUCTION**
Course Code	**: 312338**

I. RATIONALE

Building Materials and Construction is the key element in the construction project. It is a challenging job for the civil engineer to select relevant material for construction which is durable, economical and eco-friendly along with the construction procedure. At diploma level, students are expected to develop their understanding, performance-oriented abilities in order to apply their knowledge in construction industry. This course essentially imparts the knowledge of construction technology along with the processes involved in it and various construction materials used for economic and effective execution of various construction activities. This knowledge shall be used for effective and efficient utilization of these materials during the building construction.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Undertake safe building construction practices with relevant building materials.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Identify relevant type of construction materials for the given type of building.
- CO2 - Use the relevant type of special purpose construction materials in the given situation.
- CO3 - Undertake the given type of building construction activity for the given component of building structure.
- CO4 - Design the relevant means of communication for the given building structure.
- CO5 - Use the relevant type of material for finishing purpose in the given situation.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312338	BUILDING MATERIAL AND CONSTRUCTION	BMC	DSC	3	-	2	3	8	4	3	30	70	100	40	25	10	-	-	25	10	150

Total IKS Hrs for Sem. : 1 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, IKS - Indian Knowledge System, SLA - Self Learning Assessment

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

Note :

1. FA-TH represents average of two class tests of 30 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 SLA of 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.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Classify the given type of material used in the given building structure TLO 1.2 Classify the given construction material according to its sources with examples. TLO 1.3 Propose the relevant natural construction material for the given situation. TLO 1.4 Suggest the relevant type of artificial material for the given type of construction work TLO 1.5 Classify the buildings using NBC guidelines	**Unit - I Overview of construction Materials** 1.1 Scope of construction materials in various Civil Engineering Sectors. 1.2 Broad classification of materials – Sources of materials, Natural, Artificial- special, finishing and recycled. 1.3 Natural Building construction Materials – Stone, Timber, Soil, Sand and Coarse Aggregates, Bitumen: Types and uses. (IKS-Materials used in Ancient Buildings-Stone , Lime) 1.4 Artificial Building Construction Materials – Cement, Clay Brick, Flooring Tiles, Concrete Blocks, Plywood, particle board, Veneers, laminated board and Glass: Types and uses. 1.5 Introduction to National Building Code-Part III (2005) Group A to I As per Types of Constructions- Load Bearing Structures, Framed Structures,Composite Structures.	Chalk-Board Demonstration Video Demonstrations Presentations Site/Industry Visit
2	TLO 2.1 Describe the method used for water proofing in the given situation. TLO 2.2 Justify the use of fibers in given situation. TLO 2.3 Enumerate the importance of geopolymer cement in construction.	**Unit - II Special Purpose Building Construction Materials** 2.1 Special Building Construction Materials – Waterproofing, Termite proofing, Thermal and sound insulating: Types and suitability. 2.2 Fibers– Jute, Glass, Plastic Asbestos Fibers: Types and uses 2.3 Geopolymer cement: Geo-cement: properties and applications.	Chalk-Board Demonstration Video Demonstrations Site/Industry Visit Presentations Case Study

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Explain the roles and functions of given building components in civil structure TLO 3.2 Describe the process of earthwork excavation for given construction activity. TLO 3.3 Suggest relevant materials used for formwork in the given situation. TLO 3.4 Justify the type of foundation proposed in the given situation with its salient features. TLO 3.5 Undertake the construction of stone masonry in given situation. TLO 3.6 Undertake the construction of Brick masonry in given situation. TLO 3.7 Justify the necessity of scaffolding in construction.	**Unit - III Construction of substructure & Superstructure** 3.1 Building Components: Building Components & their Function: Substructure, Superstructure 3.2 Earthwork: Excavation For Foundation, Timbering and Strutting Earthwork for Embankment Material for Plinth Filling 3.3 Formwork: Definition, Requirements, Materials used, Types and Removal of Formwork. 3.4 Foundation: Functions, Types :Shallow Foundation-Stepped Footing, Wall Footing, Column Footing, Isolated and Combined Column Footing, Raft Foundation. Deep Foundation-Pile Foundation, Well foundation and Caissons, Pumping Methods of Dewatering, Deep wells, Cofferdams. 3.5 Stone Masonry: Terms used in stone masonry- facing, backing, hearting, through stone, corner stone, cornice. Type of stone masonry: Rubble masonry, Ashlar Masonry and their types. Selection of Stone Masonry. Precautions to be observed in Stone Masonry Construction. (IKS- Ancient heritage building-stone masonry work) 3.6 Brick masonry: Terms used in brick masonry- header, stretcher, closer, quoins, course, face, back, hearting, bat bond, joints, lap, frog, line, level and plumb. Bonds in brick masonry- header bond, stretcher bond, English bond and Flemish bond. Requirements of good brick masonry. Precautions to be observed in Brick Masonry Construction ,Comparison between stone masonry and Brick Masonry, Tools and plants required for construction of stone masonry and brick masonry. 3.7 Scaffolding , Shoring and Underpinning: Necessity, types, application. Process of Erection and Dismantling.	Chalk-Board Site/Industry Visit Model Demonstration Video Demonstrations Case Study Presentations Site/Industry Visit

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Classify the given types of doors based on its location, material used and dimension. TLO 4.2 Classify the relevant types of windows based on location, material and dimension. TLO 4.3 Select the relevant type of fixtures with fastener for fixing the given type of door or window. TLO 4.4 Classify the staircase on the basis of its shape and material use. TLO 4.5 Suggest the type of staircase for the given situation.	**Unit - IV Building Communication** 4.1 Horizontal Communication: Doors –Components of Doors, Types of Doors: Fully Paneled Doors, Partly Paneled and Glazed Doors, Flush Doors, Collapsible Doors, Rolling Shutters, Revolving Doors, Glazed Doors. Sizes of Door recommended by BIS. 4.2 Windows: Component of windows, Types of Windows: Fully Paneled, Partly Paneled and Glazed, Wooden, Steel, Aluminum Windows, Sliding Windows .Sizes of Windows recommended by BIS and Ventilators 4.3 Fixtures and fastenings for doors and windows. 4.4 Vertical Communication - Stair Case, Ramps, Lift, Elevator and Escalators. Terms used in staircase, Types of staircases- Straight, doglegged, open well, Circular, Quarter turn. Calculation of no of flight/s, dimensions of rise and trade.	Model Demonstration Chalk-Board Video Demonstrations Site/Industry Visit Presentations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Suggest relevant type of flooring material for for given situation. TLO 5.2 Explain the procedure for laying and Construction of floor. TLO 5.3 Describe the Procedure of Plastering of given thickness. TLO 5.4 Select the relevant type of paint for the given surface area of the building.	**Unit - V Building Finishes** 5.1 Types of Floor Finishes, laying process and its suitability- Shahabad, Kota, Marble, Granite, Kadappa, Ceramic Tiles, Vitrified, Pavement Blocks, Concrete Floors, wooden Flooring, Skirting And Dado. 5.2 Plastering – Necessity, Procedure, Single Coat and Double Coat Plaster, rough finish, Neeru Finishing and POP. 5.3 Special Plasters- Stucco Plaster, sponge finish, pebble finish. Plaster Board And Wall Claddings. 5.4 Painting –Necessity, Surface Preparation for painting, Methods of Application, Selecting Suitable Painting Material.	Site/Industry Visit Video Demonstrations Presentations Demonstration Chalk-Board

VI. 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
LLO 1.1 Identify the different Construction materials used in a construction	1	*Identify minimum three available construction materials in the laboratory and prepare a report with photos/pictures/sketches including writeup on its sources and utility.	2	CO1
LLO 2.1 Identify the grain distribution pattern used in a construction	2	Identify the grain distribution pattern of the given sample of wood material available in the laboratory and draw the various patterns to prepare concise report on it. (along and perpendicular to the grains)	2	CO1
LLO 3.1 Identify various layers and types of soil strata in foundation pit	3	Prepare the inspection report with relevant photographs by inspecting the three pits of foundation of a site to Identify the different types of layers of soil strata	2	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Record dimensions of given bricks	4	*Record the dimensions of 10 bricks to find its average dimension, weight with relevant interpretation report.	2	CO1
LLO 5.1 Perform field test on given sample of brick	5	*Perform field tests on given sample of brick such as-dropping, striking and scratching by nail and interpret the results obtained to decide its quality and prepare a report on it.	2	CO2
LLO 6.1 Apply the relevant termite chemical to prevent the surface damage	6	Apply the relevant termite chemical on given damaged surface of timber and submit the observation report after one month with photos/pictures.	2	CO2
LLO 7.1 Paint the given surface of wall after preparing a required base of relevant material	7	Apply two or more coats of selected paint on the prepared base of a given wall surface for the area of 2m x 2m using relevant tools brush/rollers adopting safe practices and prepare a report on it.	2	CO2
LLO 8.1 Prepare the cement mortar of given proportion	8	Prepare the cement mortar of proportion 1:3 or 1:6 using artificial sand as a special processed construction material and prepare a report on it with sketches/photos while preparation of mortar.	2	CO3
LLO 9.1 Assemble one and half Brick thick wall in given bond.	9	*Assemble one and half Brick thick wall in a English Bond and prepare a report on it with pictures/photos.	2	CO3
LLO 10.1 Assemble one and half Brick thick wall in given type of bond.	10	Assemble Brick thick wall in a Flemish Bond. (minimum 3 Course) and prepare a report on it with sketches/photos.	2	CO3
LLO 11.1 Prepare a site visit report with reference to following: stone masonry, construction site, components of staircase, components of doors & windows, types of flooring, process of plastering, pointing	11	Prepare a visit report with sketches/photos by arranging visit to stone masonry construction work.	2	CO3
LLO 12.1 Prepare a site visit report with reference to following: stone masonry, construction site, components of staircase, components of doors & windows, types of flooring, process of plastering, pointing	12	Prepare a visit report with sketches/photos of construction site with respect scaffolding, formwork and centering work.	2	CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 13.1 Prepare a site visit report with reference to following: stone masonry, construction site, components of staircase, components of doors & windows, types of flooring, process of plastering, pointing	13	*Prepare report with labelled sketches of inspected staircase components during site visit.	2	CO4
LLO 14.1 Prepare a site visit report with reference to following: stone masonry, construction site, components of staircase, components of doors & windows, types of flooring, process of plastering, pointing	14	*Prepare report with labelled sketches of inspected doors and windows components during site visit.	2	CO4
LLO 15.1 Prepare a site visit report with reference to following: stone masonry, construction site, components of staircase, components of doors & windows, types of flooring, process of plastering, pointing	15	Prepare report with labelled sketches of inspected flooring and roofing materials during site visit.	2	CO5
LLO 16.1 Prepare a site visit report with reference to following: stone masonry, construction site, components of staircase, components of doors & windows, types of flooring, process of plastering, pointing	16	*Prepare a visit report with sketches/photos by observing the process of plastering and pointing of a masonry work at construction site.	2	CO5
LLO 17.1 Prepare a site visit report with reference to following: stone masonry, construction site, components of staircase, components of doors & windows, types of flooring, process of plastering, pointing	17	Prepare a visit report with sketches/photos by observing keenly the process of painting in residential / public building.	2	CO5
LLO 18.1 Carry out market survey of construction materials	18	*Carry out market survey of the building materials used for Brickwork,Flooring,Plastering and Painting, available in your city & prepare a report (each of five).	2	CO1 CO2
LLO 19.1 Prepare the site visit report of the nearby heritage structure	19	Prepare the site visit report of the nearby heritage structure to inspect the Civil Engineering attributes with reference to IKS.	2	CO1 CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Collection of information related to different techniques of demolition of existing structure.
- Collect the market rates for following construction materials from various dealers/suppliers of local market for different brands. i. Bricks. ii. Stone / aggregate (20 mm, 40 mm and 80 mm) iii. Teak wood. iv. Flooring tiles. v. Ordinary Portland Cement vi. Oil paint vii. Cement Paint viii. Plaster of Paris ix. Plastic paints x. Recent types of paint.
- Collect the technical brochures of following construction materials. i. Ordinary Portland Cement ii. Vitrified flooring tiles. iii. Particle boards used for aluminum partitions. iv. Paints.
- Undertake a market survey for the cost and technical specification of different brands of following construction Materials and prepare comparison chart. i. Cement ii. Tiles iii. Glass iv. Paints.
- Collection of information related to recent technologies used in building construction.
- Identify the different types of cracks and remedial measures for existing structure (Case Study).
- Visit to the site to check different construction activities as per the check list.

Assignment

- 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: Students should conduct following activities in group and prepare reports.
- Undertake a market survey of different construction materials and compare the following points. i. Structure ii. Properties iii. Applications.
- Prepare journals consisting of sketches of construction materials.
- Undertake a market survey from local dealers for procurement of civil engineering material.
- Inspect the various activities related to Construction material at sites of different civil structures.

- Literature survey of available at institute library regarding construction material used for different purposes and situations.
- Develop Power point presentation or animation for demonstrating laying and fixing the construction materials.
- Classify the buildings with reference to National Building Code- Part III (2005). ii. Identify the components of a building by observing the model. iii. Organize the visit to construction site to observe brickwork, Sill, Lintel, Chajja, Slab, Parapet wall, flooring.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Weighing balance	4,7,8
2	Pan, spade	4,7,8
3	Steel Tape	4,7,13,14,15
4	Saw of different types (Rip saw having 4 to 6 mm pitch, cross cut saw with tooth pitch 2 to 3 mm, panel saw)	2
5	Painting brushes of different size for oil, acrylic painting and rollers of different size for smooth finishing work.	7
6	Trowels (Brick, Buttering, Pointing) , triangular, ranging in size up to about 11 inches (279.40 mm) long and from 101.6 mm to 203.2 mm wide i.e. (4 to 8 inches wide).	7,8
7	Portable Hammer,Spade, Pans (Ghamela), Thread, lime	9,10
8	Square, mason’s level, and straightedge 28.57 mm to 38.10 mm and the middle portion of the top edge from 152.40 mm to 254 mm wide	9,10
9	Ordinary Portland Cement, PPC	8
10	Bricks and blocks of different sizes.	4
11	Paints-OBD, acrylic, plastic emulsion.	7
12	Models: a) Cut section of building showing different components b) Types of Bonds in Brick masonry c) Types of Door and Windows d) Types of Stairs e) Types of Roofs f) Formwork for different RCC elements g) Types of scaffolding	9,10,13

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Overview of construction Materials	CO1	7	4	4	4	12

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
2	II	Special Purpose Building Construction Materials	CO2	6	0	4	4	8
3	III	Construction of substructure & Superstructure	CO3	14	4	12	8	24
4	IV	Building Communication	CO4	12	2	6	8	16
5	V	Building Finishes	CO5	6	0	6	4	10
Grand Total				**45**	**10**	**32**	**28**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Term work, Self-Learning (Assignment) , Question Answer in Classroom, Quiz and Group Discussion. Each practical will be assessed considering- 60% weightage to process and 40% weightage to product.

Summative Assessment (Assessment of Learning)

- Pen Paper test / Oral Exam/ Practical Exam

XI. 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	2	1	-	1	1	1	1				
CO2	2	1	-	1	2	1	1				
CO3	3	2	1	2	2	1	2				
CO4	3	2	1	2	2	1	2				
CO5	3	2	1	2	1	1	2				

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Ghose, D. N.	Construction Materials	Tata McGraw Hill, New Delhi, 2014 ISBN: 9780074516478
2	Rangwala, S.C.	Engineering Materials	Charator publisher, Ahemdabad, 2015, ISBN: 9789385039171
3	S. P. Arora and Bindra	Building Construction	Dhanpat Rai Publication, Delhi Edition 2013,ISBN: 9788189928803
4	S. C. Rangawala	Building Construction	Charotar Publication,Dist-Anand ISBN-10: 8185594856 ISBN-13: 978-8185594859
5	Sushil Kumar	Building Construction	Standard Publication, Edition 2010,ISBN: 9788180141683, 8180141683
6	BIS	National Building Code	Bureau of Indian Standard, New Delhi
7	BIS	BIS 962-1989 Code of Architectural and Building Drawing	Bureau of Indian Standard, New Delhi
8	BIS	BIS 1038- 1983 Steel Doors, Windows and Ventilators	Bureau of Indian Standard, New Delhi

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=XsFeVuVQE-E	Introduction to Building Materials

Sr.No	Link / Portal	Description
2	https://www.youtube.com/watch?v=C6x_ersOn_o	Building Blocks of Bharat
3	https://www.youtube.com/watch?v=3XGt-p-hpdU	Brick Masonry Construction
4	https://www.youtube.com/watch?v=L-VGe2j53NU	15 Essential Tips for Building a 4" Thick Brick Masonry Wall: Expert Construction Guide
5	https://www.youtube.com/watch?v=Yg4BLy7f-iI	Introduction to fix formwork for column at site
6	https://www.youtube.com/watch?v=fDKRtQqKzJM	Steps of Plastering

Programme Name/s	**: Agricultural Engineering/ Civil Engineering/ Civil & Rural Engineering/ Construction Technology/ Civil & Environmental Engineering**
Programme Code	**: AL/ CE/ CR/ CS/ LE**
Semester	**: Second**
Course Title	**: SURVEYING**
Course Code	**: 312339**

I. RATIONALE

Surveying is generally used to make land maps and boundaries. The development of engineering survey is the basic foundation to ensure the quality of the project, because it can provide accurate data for the subsequent construction. Surveying is involved in everything right from accurately drawing boundaries between private and public land, to inspecting bridges and other critical infrastructure. Without surveying, the placement, security, and safety of projects cannot be assured. Therefore, the students are required to develop such competency to carry out the given type of survey using relevant equipment's so as to prepare the plan to interpret the information to take the appropriate decisions. This course will help the students in achieving in above mentioned goal.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Prepare plans and Contour maps using Surveying Equipment’s and Techniques.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Suggest relevant type of survey required for the given situation.
- CO2 - Undertake cross staff and compass survey for the given field
- CO3 - Undertake survey using Theodolite for preparing a plan of the given terrain.
- CO4 - Determine Reduced Level to prepare Contour maps for the given type of terrain
- CO5 - Prepare the plan using Plane Table Surveying to locate relevant details.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme										
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical					
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312339	SURVEYING	SUY	SEC	3	-	4	1	8	4	3	30	70	100	40	25	10	50#	20	25	10	200

Total IKS Hrs for Sem. : 1 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, IKS - Indian Knowledge System, SLA - Self Learning Assessment

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

Note :

1. FA-TH represents average of two class tests of 30 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 SLA of 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.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the given basic principles of surveying. TLO 1.2 Classify the survey based on purpose, instruments used and nature of field. TLO 1.3 Use the conventional sign and symbols for preparing the plan of a given land.	**Unit - I Overview and Classification of Surveying** 1.1 Surveying: Introduction, Purpose, use and Principles. 1.2 Types of surveying- Primary and Secondary classification, Plane, Geodetic, Cadastral, Hydrographic, Photogrammetry Aerial, Layout survey, Control survey, Topographical survey, Route survey, Reconnaissance survey. 1.3 Conventional sign and symbols	Demonstration Assignment Video Demonstrations Chalk-Board Presentations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Describe the procedure of finding the distance between two given inter-visible and invisible survey stations. TLO 2.2 Explain the given Survey line and survey station used in survey. TLO 2.3 Explain the methods of ranging. TLO 2.4 Calculate the area of open field using chain and cross staff survey. TLO 2.5 Define Geographic/True Magnetic and Arbitrary Meridians and Bearings, Meridian and Bearing, TLO 2.6 Convert the Whole circle bearing to reduced bearing system and vise versa TLO 2.7 Calculate internal and external angle from bearing of line TLO 2.8 Determine the correct bearing from given Data TLO 2.9 Apply Bowditch's rule to complete the traverse of given land	**Unit - II Cross Staff and Compass Surveying** 2.1 Linear Measurement Instruments: Metric Chain, Tapes, Arrow, Ranging rod, Open cross staff (IKS) 2.2 Chain survey Station, Base line, Check line, Tie line, Offset, Tie station, Types of offsets: Perpendicular and Oblique 2.3 Ranging: Direct and Indirect Ranging. 2.4 Area Calculations of field by cross staff (Numerical problems) 2.5 Compass Traversing: open, closed. 2.6 Technical Terms: Geographic/True Magnetic and Arbitrary Meridians and Bearings, Meridian and Bearing, 2.7 Whole Circle Bearing System and Reduced Bearing System . Numerical on conversion of given bearing to another bearing (from one form to another), Fore Bearing and Back Bearing, 2.8 Calculation of internal and external angles from bearings at a station. 2.9 Components of Prismatic Compass and their Functions (No sketch) Temporary adjustments and observing bearings 2.10 Local attraction, Methods of correction of observed bearings-Correction at station and correction to included angles 2.11 Methods of plotting a traverse and closing error, Graphical adjustment of closing error.	Demonstration Chalk-Board Hands-on Collaborative learning Video Demonstrations Model Demonstration Presentations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Explain the given components of a transit Theodolite. TLO 3.2 Explain the relationship between the given fundamental axis of theodolite along with typical characteristics TLO 3.3 Describe the procedure to measure the horizontal Angle using Theodolite for the given situation. TLO 3.4 Describe the procedure to measure vertical angles using Theodolite for the given situation. TLO 3.5 Compute Latitude, Departure, Consecutive co ordinates. Independent coordinates from the data given. TLO 3.6 Determine the type of traverse by undertaking relevant check in the given situation. TLO 3.7 Calculate the bearing from given angles. TLO 3.8 Apply Bowditch's rule along with Transit rule to balance the traverse for a given data. TLO 3.9 Prepare Gale's Traverse table for the given data.	**Unit - III Theodolite Surveying** 3.1 Types and uses of Theodolite; Component parts of transit Theodolite and their functions, Reading the Vernier of transit Theodolite 3.2 Technical terms- Swinging, Transiting, Face left, Face right 3.3 Fundamental axes of transit Theodolite and their relationship 3.4 Temporary adjustment of transit Theodolite 3.5 Measurement of horizontal angle- Direct and Repetition method, Errors eliminated by method of repetition 3.6 Measurement of vertical Angle 3.7 Theodolite traversing by included angle method and deflection angle method 3.8 Checks for open and closed traverse, Calculations of bearing from angles 3.9 Traverse computation-Latitude, Departure, Consecutive coordinates, independent coordinates, Balancing the traverse by Bowditch's rule and Transit rule, Gale's Traverse table computation	Model Demonstration Chalk-Board Hands-on Collaborative learning Video Demonstrations Site/Industry Visit Case Study Demonstration Presentations

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Explain the terms Level surfaces, level line, Horizontal and vertical surfaces, Datum, Bench Marks- GTS, Permanent, Arbitrary and Temporary, Reduced Level, Line of collimation, Back sight, Fore sight, intermediate sight, Change point, Height of instruments TLO 4.2 Explain the Construction of given levelling equipment with its silent features. TLO 4.3 Explain the temporary adjustments of dumpy level. TLO 4.4 Calculate Reduced Level of the given station using relevant method of surveying. TLO 4.5 Justify the relevant types of levelling with examples. TLO 4.6 Interpret the contour maps for the given type of topography. TLO 4.7 Describe the characteristics of contours for the given terrain.	**Unit - IV Levelling and Contouring** 4.1 Terminologies: Level surfaces, level line, Horizontal and vertical surfaces, Datum, Bench Marks- GTS, Permanent, Arbitrary and Temporary, Reduced Level, Line of collimation, Back sight, Fore sight, intermediate sight, Change point, Height of instruments 4.2 Types of levels: Dumpy, Auto level, Digital level, Fundamental axis of Dumpy Level . Temporary adjustments of Level. 4.3 Types of Levelling Staffs: Self-reading staff and Target staff. 4.4 Reduced level by Plane of collimation method and Rise/ Fall Method 4.5 Fnd the R. L. by H.I. method with necessary checks (Numerical problems) 4.6 Find the R.L by Rise and Fall method with necessary checks. (Numerical problems) 4.7 Types of Leveling : Simple, Differential, Fly, Profile and Reciprocal Levelling 4.8 Contour, contour interval, horizontal equivalent. 4.9 Contour maps: Characteristics and uses of Contour maps 4.10 Methods of Locating Contour: Direct and Indirect	Model Demonstration Video Demonstrations Chalk-Board Hands-on Collaborative learning Presentations Demonstration Case Study

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Explain the functions and use of the given type of accessories of a plane table. TLO 5.2 Describe the method of orienting the plane table in a given situation. TLO 5.3 Select the relevant method of plane tabling for a given situation.	**Unit - V Plane Table Surveying** 5.1 Principle of plane table survey. 5.2 Accessories of plane table and their use, Telescopic alidade. 5.3 Setting of plane table; Orientation of plane table - Back sighting and Magnetic meridian method 5.4 Methods of plane table surveys- Radiation, Intersection and Traversing. 5.5 Merits and demerits of plane table survey.	Model Demonstration Presentations Chalk-Board Collaborative learning Hands-on Demonstration Case Study

VI. 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
LLO 1.1 Find the distance between two given inter-visible points.	1	*Measure the distance between two intervisible survey stations using chain, tape and ranging rods.	2	CO2
LLO 2.1 Undertake chain and cross staff survey for the given plot	2	*Determine area of open field using chain and cross staff survey.	2	CO2
LLO 3.1 Calculate area of irregular plot from given plan of plot	3	Determine area of irregular field using Digital Planimeter	2	CO2
LLO 4.1 Determine bearing using Prismatic Compass	4	*Measure Fore Bearing and Back Bearing of survey lines of open traverse using Prismatic Compass	2	CO2
LLO 5.1 Prepare traverse using Prismatic Compass	5	*Measure Fore Bearing and back bearing of a closed traverse of 5 to 6 sides and correct the bearings and included angles.	4	CO2
LLO 6.1 Use transit theodolite to measure Horizontal angle by Direct Method.	6	Measure Horizontal angle by using Transit Theodolite by Direct Method	2	CO3
LLO 7.1 Use transit theodolite to measure Horizontal angle by method of Repetition	7	*Measure Horizontal angle by using Transit Theodolite by method of Repetition	4	CO3

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 8.1 Use transit theodolite to measure Vertical angle	8	*Measure vertical angle using Transit Theodolite	4	CO3
LLO 9.1 Prepare traverse using Transit Theodolite	9	*Use transit theodolite to carry out Survey Project for closed traverse for minimum 5 sides ***(Compulsory).***	6	CO2 CO3
LLO 10.1 Undertake differential leveling by Height of instrument method using dumpy level/Auto Level and leveling staff.	10	*Determine Reduced Level by Height of Instrument Method	4	CO4
LLO 11.1 Undertake differential leveling by Rise and fall method using dumpy level/Auto Level and leveling staff.	11	*Determine Reduced Level by Rise and Fall Method	4	CO4
LLO 12.1 Undertake fly leveling with double check using dumpy level/ Auto level and leveling staff	12	*Perform Fly Levelling to check levelling work	2	CO4
LLO 13.1 Perform Road profile and cross section of given terrain	13	*Profile leveling and cross-sectioning for a road length of 300 m with cross-section at 20 m interval**.** ***(Compulsory)***.	6	CO4
LLO 14.1 Undertake differential levelling operation for agriculture land	14	Undertake differential leveling by using dumpy level/Auto Level and leveling staff for Installation of irrigation pipelines	4	CO4
LLO 15.1 Conduct block contouring for the area of 40m x 40m to draw its contour plan	15	Prepare Contour Plan/map using Block Contouring for the area of 40m x 40m to draw its contour plan	4	CO4
LLO 16.1 Prepare Contour Plan/map using block contouring method	16	*Plotting contour map using block contouring method for a block of 150m x 150m with grid of 10m x 10m for given land parcel. ***(Compulsory).***	6	CO4
LLO 17.1 plotting contour map using block contouring method for 10 Are Agriculture land.	17	Prepare Contour plan for control farming using block contouring method	2	CO4
LLO 18.1 Use plane table survey to prepare plan and locate details by using Radiation Method.	18	*Prepare plans and locate details by using Radiation Method.	2	CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 19.1 Use plane table survey to prepare plans and locate details by Intersection Method	19	*Prepare plans and locate details by Intersection Method	2	CO5
LLO 20.1 Use plane table survey to prepare plans locate details by Traversing Method	20	*Prepare traverse using Plane table Surveying	4	CO5
LLO 21.1 Use plane table survey to prepare plans plan to establish plant nursery	21	Prepare plan to establish plant nursery	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Collect the contour maps of different terrains available with various authorities & prepare a report on its interpretation.
- Determine the RLs of the components of existing structures like Plinth, lintels, chajja, slab, and beam etc
- Collect the information of survey instruments available in the market with their specifications.
- Prepare a flex chart to explain one method of plane tabling.
- Compare Traversing with plane table and compass method
- Perform reconnaissance survey for plotting the alignment of road.
- Observe Topographical maps and interpret the details
- Carry out comparative study of following survey instruments of different make and brands : Auto level and Dumpy Level
- Collect the map of city /town and calculate the ward wise and total area using digital planimeter.

Assignment

- Explain one method each to measure the distance between points on either side of obstacles in case of following: River, Lake, Building.
- Set the alignment of proposed road using Theodolite

- Interpret the given contour maps.
- Draw the representative contour maps for the following: Ridge of a mountain, Hillock, Valley, Pond/lake, Gentle slope, Very Steep Slope, Plain Surface
- Determine the reservoir capacity from a give contour map of reservoir.
- Measure area of small open ground by plane tabling.
- Measure the height of the flag post using Theodolite.
- Determine the reservoir capacity from a give contour map of reservoir.

Note :
"These are the just suggestive topics. Faculty must design Microproject/Activities/ Assignments based on Course Outcome requirements".

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Metric Chain made from galvanized mild steel wires 4mm in dia, brass handles with swivel joints, brass tallies provided at every 5 m length of chain - 20 and 30m.	1,2
2	Pegs of length 400 mm and c/s area of 50 mm x 50 mm	1,2,3,4,5,6,7,8,9,18,19,20,21
3	Arrows 400 mm long and made up of good quality hardened and tempered steel wire of 4 mm in diameter.	1,2
4	Metallic Ranging rods of 2 m length, circular or octagonal in cross section of 30 mm diameter, Lower shoe of 150 mm long. Painted in black, white and red stripes of 200 mm each.	1,2,3,4,5,6,7,8,9,13,14,15,16,17,18,19,20,21
5	Prismatic compass confirming to IS 1957-1961 with stand, made in Gun metal material having diameter of 85-110 mm and the least count of 30 minutes.	4,5
6	Dumpy level and automatic levels confirming to IS: 9613 – 1986 with stand and internal focusing telescope of standard make.	10,11,12,13,14,15,16,17
7	Leveling staff- 2 m and 4 m, telescopic type confirming to IS 11961 -1986 or Folding type confirming to IS 1779 (1961), 5 mm least count	10,11,12,13,14,15,16,17
8	Digital planimeter of standard make with Ni Cd batteries and AC Adapters	3
9	Plane table with accessories- Plane and telescopic Alidade, Trough compass, U-fork ,Spirit level.	18,19,20,21

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
10	Twenty Second Transit theodolite with accessories.	6,7,8,9
11	Metallic tape-, Steel tape, Invar, Fiber glass tape satisfying IS 1269 (Part 1 and Part 2) : 1997 specifications	1,2,5,9,13,14,15,16,17,18,19,20,21

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Overview and Classification of Surveying	CO1	4	2	4	0	6
2	II	Cross Staff and Compass Surveying	CO2	10	4	4	6	14
3	III	Theodolite Surveying	CO3	13	4	4	12	20
4	IV	Levelling and Contouring	CO4	14	2	8	12	22
5	V	Plane Table Surveying	CO5	4	4	4	0	8
Grand Total				**45**	**16**	**24**	**30**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Termwork, Assignment, Microproject (60% Weightage to process and 40% weitage to product), Question and Answer

Summative Assessment (Assessment of Learning)

- Pen and Paper Test (Written Test), Practical Exam, Oral Exam

XI. 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	----	----	----	----	----	2			
CO2	3	3	1	2	1	1	3			
CO3	3	3	2	3	1	2	3			
CO4	3	3	2	3	1	2	3			
CO5	3	2	2	3	1	2	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Kanetkar T. P.; Kulkarni, S. V.	Surveying and Levelling volume I	Pune Vidyarthi Gruh Prakashan, Pune; ISBN:978-81-858-2511-3
2	Basak, N. N.	Surveying and Levelling	McGraw Hill Education, New Delhi ISBN 93-3290-153-8
3	S. K. Duggal	Survey I	McGraw Hill Education, New Delhi, ISBN: 978-00-701-5137-6
4	Punmia, B.C, Jain, Ashok Kumar Jain, Arun Kumar	Surveying I	Laxmi Publications., New Delhi. ISBN: 8-17-008853-4
5	Bhavikatti, S. S.	Surveying and Levelling, Volume 1	I. K. International, New Delhi ISBN: 978-81-906-9420-9

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://archive.nptel.ac.in/courses/105/104/105104101/	Introduction to Surveying, Principles of surveying, and Classification of Surveying
2	https://lnct.ac.in/wp-content/uploads/2020/03/UNIT-4B.pdf	Theodolite Surveying
3	https://www.slideshare.net/gauravhtandon1/plane-table-survey-27614680	Plane Table Surveying-accessories and methods
4	http://www.pkace.org/Lecture_Notes/Survey-lecture-notes.pdf	Levelling-methods of levelling and types of levels
5	https://dspmuranchi.ac.in/pdf/Blog/Survey.pdf	Surveying and Levelling
6	https://civilplanets.com/compass-surveying/	Compass Surveying and its types, Temporary adjustmments
7	http://ecoursesonline.iasri.res.in/mod/page/view.php?id=1282 85	Traversing by Prismatic Compass, WCB and RB conversion and Terms in Compass Surveying
8	https://www.youtube.com/watch?v=x9ZPMxrlS3U	Measurement of bearing by prismatic compass
9	https://youtu.be/j8poe2vvD2Q	Temporary adjustment of auto level
10	https://www.youtube.com/watch?v=c9U0xlmCzGI	Temporary adjustment of Transit Theodolite
11	https://youtu.be/L54T4uvpMTg	Levelling operation by using Dumpy Level
12	https://www.youtube.com/watch?v=boPrQFZEn9A	Radiation method by plane table surveying
13	https://www.youtube.com/watch?v=PQfr1LABZWg	Contouring and its characteristics, Methods of Contouring
14	https://www.youtube.com/watch?v=-mkf7uJG8DI	Intersection method of Plane Table Surveying
15	https://theconstructor.org/surveying/chain-survey/29812/	Chain, Tapes and other linear measurement equipments

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Surface Coating Technology/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ FC/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ SC/ TC/ TE/ TR/ TX**
Semester	**: Second**
Course Title	**: PROFESSIONAL COMMUNICATION**
Course Code	**: 312002**

I. RATIONALE

Communication is key to smooth and efficient functioning of any industry or business . Professional communication is the need of every organization to maintain ethics, quality and standards. The efficacy of business communication skills are essential for engineering professionals to instruct, guide and motivate peers/ subordinates to achieve desired goals at work place. Strong

Communication skills are highly valued in the professional world and contribute to career growth and opportunities. Thus, this course has been designed to enhance the professional communication skills for effective presentation both in written and oral forms at workplace.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

1. Communicate effectively at workplace. 2. Issues can be identified and resolved by brainstorming solutions 3. Effective communication ensures strong decision making

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Communicate effectively (oral / spoken and Written) in various formal and informal situations minimizing the barriers.
- CO2 - Develop listening skills through active listening and note taking.
- CO3 - Write circulars, notices and minutes of the meeting.
- CO4 - Draft inquiry letter, complaint letter , Job application with resume / CV, Compose effective E - mails .
- CO5 - Write Industrial reports.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312002	PROFESSIONAL COMMUNICATION	PCO	SEC	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50

Total IKS Hrs for Sem. : 0 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, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 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 SLA of 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.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe the importance of professional communication in given situations TLO 1.2 Identify the types of communication barriers in given situations and suggestive remedies TLO 1.3 Use different types of verbal and non–verbal communication for the given situation	**Unit - I Professional Communication : An Overview** 1.1 Definition of professional communication- Importance, relevance, Elements and process of communication 1.2 7 C's of Professional Communication (Clarity, Conciseness, correctness, Coherent, concrete, courteous and Complete) 1.3 Types –Verbal (Oral-Written),Formal, Informal (Grapevine), Vertical 1.4 Barriers to communication,Types of barriers (Linguistic, Psychological, Technological)	Language lab Role plays Chalk board Reference books Case studies
2	TLO 2.1 Identify the difference between listening and hearing TLO 2.2 Differentiate the types of listening in various situations TLO 2.3 Take notes during lectures, seminars . Make use of types of note taking and note making for different subjects / topics	**Unit - II Listening & Note Taking** 2.1 Difference between listening & Hearing 2.2 Types of listening a)Active listening b)Passive listening c)Selective listening 2.3 Techniques of Note taking , Types of note taking (Outline notes, Mind Mapping, Flowcharts)	Language Lab Classroom learning NPTEL Role Play
3	TLO 3.1 Prepare notices / agenda for the given type of meeting / information TLO 3.2 Prepare minutes of meeting/s TLO 3.3 Draft a circular for a particular information/ event	**Unit - III Office Drafting** 3.1 Format of Notice and Circular 3.2 Drafting Agenda 3.3 Preparing Minutes of meeting	white board Language Lab Reference books Classroom learning
4	TLO 4.1 Compose cover letter and CV / Resume for jobs TLO 4.2 Apply E- mail Etiquette for professional purposes TLO 4.3 Compose E- mails for different official purposes	**Unit - IV Writing Skills for Professional Communication** 4.1 Job Application with Resume / CV 4.2 E-Mail Etiquettes 4.3 Writing official E- Mails to communicate intended purposes 4.4 Drafting Enquiry letter and Complaint letter	Language lab Classroom learning NPTEL Reference books

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Compose technical reports TLO 5.2 Draft accident / Investigation/ Daily reports	**Unit - V Report Writing** 5.1 Introduction to report writing 5.2 Accident Report 5.3 Investigation Report 5.4 Daily Report	Chalk and talk Language Lab Collaborative learning Classroom learning

VI. 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
LLO 1.1 Draw communication cycle using real life examples and explain process of communication.	1	*Communication Process and Cycle	2	CO1
LLO 2.1 Undertake the Role play / Group discussion to illustrate types / barriers to communication	2	Role plays and Group Discussion	2	CO1
LLO 3.1 Listen to audios in the language lab and make notes of it.	3	*Active Listening	2	CO2
LLO 4.1 Give a presentation / Seminar using 7 C's of Communication.	4	*Presentations / Seminars	2	CO1
LLO 5.1 Explain the types of note taking with examples and make notes on any one topic related to your curriculum.	5	*Note taking and Note Making	2	CO2
LLO 6.1 Prepare agenda for meeting and draft minutes of the meeting.	6	*Agenda and Minutes of the meeting	2	CO3
LLO 7.1 Draft circulars for the given situation .	7	*Office Drafting	2	CO3
LLO 8.1 Respond to job advertisements referring newspapers, LinkedIn. Write cover letter with resume /CV.	8	*Type Job Application with Resume / CV	2	CO4
LLO 9.1 Type Four (formal) E-mails using ethics and etiquette.	9	* E- Mail writing	2	CO4

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 10.1 Write a detailed report on Accident/ Investigation .	10	*Technical Report writing	2	CO5
LLO 11.1 Prepare a case study related to linguistic barriers : language ,pronunciation, punctuation, technical jargon and suggest remedies for the same.	11	*Barriers to Communication	2	CO1
LLO 12.1 Draft complaint / enquiry letter for various situations	12	Complaint and Enquiry letter	2	CO4
LLO 13.1 List psychological barriers to communication LLO 13.2 Prepare case studies on any two psychological barriers and suggest remedies to overcome the barriers	13	Psychological barriers to Communication	2	CO1
LLO 14.1 Draw flow chart and mind mapping for any topic related to the curriculum.	14	*Listening Skills	2	CO2
LLO 15.1 Face mock interview arranged by your teacher.	15	* Typed Job Application , Resume / CV/ formal dressing and Interview	2	CO4

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Conduct an interview of any person and follow the procedure (interview questions, photo with the interviewee etc.)
- Listening and Speaking are life long learnings . Explain with appropriate examples and real life case studies.
- Collect (four to five) emails with technical jargons, barriers, make required corrections and keep a record of both the mails (original and Corrected one)
- Complete any one certification course of (Two Weeks duration) from (MOOC/ NPTEL/ Coursera/ any other source)related to Communication Skills / Personality Development.
- Prepare a report on aspects of body language
- Prepare a case study on Technological /Psychological barriers to communication

Reading for vocabulary and sentence structure

- Read any motivational book and present a review of the book

Note :

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. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. 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 15 (fifteen) student engagement hours during the course. In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should 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. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Language Lab with software and internet facility	All
2	LCD Projector	All
3	Smart Board with networking	All
4	Printer	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table) : NOT APPLICABLE

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Term Work, Micro Project

Summative Assessment (Assessment of Learning)

- Practical Exam of 25 marks using language lab

XI. 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	1	1	1		1	3	1			
CO2	1	1				3	1			
CO3	1					3	1			
CO4		1				3	1			
CO5		1	1			3	1			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	M Ashraf Rizvi	Effective Communication Skills	Tata McGraw-Hill Publication-ISBN 0070599521, 9780070599529
2	Sanjay Kumar and Pushp Lata	Communication Skills	Oxford University Press ISBN 9780199457069
3	MSBTE Textbook	Communication Skills	MSBTE
4	Robert King	Effective communication Skills	Audio Book -ISBN 978181667009742
5	N P Sudharshana , C Savitha	English for Technical Communication	Cambridge-ISBN 978-13-16640-08-1

Sr.No	Author	Title	Publisher with ISBN Number
6	C. Murlikrishna , Sunita Mishra	Communication Skills for Engineers	Pearson - ISBN 978-81-317-3384-4
7	Meenakshi Raman, Sangeeta Sharma	Technical Communication, Principles and Practice	Oxford University Press -ISBN 978-13-16640-08-1
8	K. K. Sinha	Business Communication	Galgotiya Publishing company, New Delhi -ISBN 9789356227064
9	Rajendra Pal, J.S. Korlahalli	Essentials of Business Communication	Sultan Chand & Sons, New Delhi ISBN 9788180547294

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.britishcouncil.in	conversations
2	https://www.coursera.org	certification courses
3	https://www.udemy.com	Communication skills training courses
4	http://www.makeuseof.com	Dale Carnegie's free resources

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Hotel Management & Catering Technology/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Surface Coating Technology/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ FC/ HA/ HM/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ SC/ TC/ TE/ TR/ TX**
Semester	**: Second**
Course Title	**: SOCIAL AND LIFE SKILLS**
Course Code	**: 312003**

I. RATIONALE

Rationale : Life skills can be defined as abilities that enable humans to deal effectively with the demands and challenges of life. Social skills are a subset of life skills that are needed for successful, healthy relationships to easily adapt when moving from one social situation to the next. They help regulate our emotions effectively and develop enduring, supportive relationships, we're happier and healthier. This is why developing life skills and eventually social skills is key not only to being successful in life, it's key for our health and well-being. Thus, Teaching of Social and life skills provide students with essentials of knowing , understanding attitudes, values, morals ,social skills and better equip them to handle stress and build their self efficacy, self esteem and self confidence.

Note : The course offers five different alternatives(modules) for achieving above outcomes . Students must complete any one module from the following given options.

a. MODULE-I : Unnat Maharashtra Abhiyan (UMA)
b. MODULE-II : National Service Scheme (NSS)
c. MODULE-III : Unniversal Human Values
d. MODULE-IV: Value Education (Unnati Foundation)
e. MODULE-V : Financial Literacy (NABARD)

The institute can choose to offer any one MODULE to the groups of the students by taking into consideration the resources required and resources available in the institute . Different group of students maybe offered different MODULE based on their choices .

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Demonstrate critical social and life skills ethics, resilience, positive attitude , integrity and self-confidence at workplace and society at large.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Enhance the ability to be fully self-aware and take challenges by overcoming all fears and insecurities and grow fully.
- CO2 - Increase self-knowledge and awareness of emotional skills and emotional intelligence at the place of study/work.
- CO3 - Provide the opportunity to realizing self-potential through practical experience while working individually or in group.
- CO4 - Develop interpersonal skills and adopt good leadership behaviour for self-empowerment and empowerment of others.
- CO5 - Set appropriate life goals with managing stress and time effectively.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL Practical				Based on SL		Total Marks
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312003	SOCIAL AND LIFE SKILLS	SFS	VEC	-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50

Total IKS Hrs for Sem. : 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, IKS - Indian Knowledge System, SLA - Self Learning Assessment

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

Note :

1. FA-TH represents average of two class tests of 30 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 SLA of 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.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.

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1	TLO 1.1 Explain developmental needs and connection of various stakeholders TLO 1.2 Enlist the local problems TLO 1.3 Design a methodology for fieldwork TLO 1.4 Select the attributes of engineering and social system for measurement, quantification, and documentation TLO 1.5 Measure & quantify the quantities / systems parameters TLO 1.6 Write a report using information collected tStudy the data collected from fieldwork and conclude the observations	**MODULE I : Activities Under Unnat Maharashtra Abhiyan (UMA)** 1.1 Introduction to Societal Needs and respective stakeholders : Regional societal issues that need engineering intervention 1.2 Multidisciplinary approach-linkages of academia, society and technology 1.3 Stakeholders' involvement 1.4 Introduction to Important secondary data sets available such as census, district economic surveys, cropping pattern, rainfall data, road network data etc 1.5 Problem Outline and stakeholders : Importance of activity and connection with Mapping of system components and stakeholders (engineering / societal) 1.6 Key attributes of measurement 1.7 Various instruments used for data collection - survey templates, simple measuring equipments 1.8 Format for measurement of identified attributes/ survey form and piloting of the same 1.9 Fieldwork : Measurement and quantifications of local systems such as agriculture produce, rainfall, Road network, production in local industries, Produce /service which moves from A to B 1.10 Analysis and Report writing Report writing containing- 1. Introduction of the topic 2. Data collected in various formats such as table, pie chart, bar graph etc 3. Observations of field visits and data collected.	i) Group discussion ii) Role play iii) Case study iv) Seminar and presentation **<u>Implementation guidelines suggested</u>** The course will be implemented in eight sessions and fieldwork: a) Session I - Introduction to development paradigm, fieldwork and case study as pedagogy b) Session II - VII - Society, stakeholders and value creation, measurements, rudimentary analysis and reporting c) Session VIII - Final closure session feedback and assessment d) Field work - 1. Pilot Visit - Pilot of survey instrument 2. Survey Visit 1 - Data gathering / Information Collection 3. Survey Visit 2 - Data gathering 4. Summary Visit - Closure after analysis **Methodology:** Considering the nature of the course designed, following points shall be considered while implementing the course. i) Regroup in the batches of 5-6 students for conducting the fieldwork from the bigger group. ii) Assign a few batches of the students for this course to all the faculty members. iii) A group of course teachers will visit local governance bodies such as Municipal Corporations, Village Panchayats, Zilla Parishads, Panchayat Samitis to assess the small technological / engineering needs in their area of work. iv) The group of course teachers will carry

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			out initial field visits to evaluate the various possibilities of field visits / various scenarios where in students can conduct field work to measure / quantify the parameters / attributes.
2	TLO 2.1 Adopt a Village or Slum for providing needed services to the community TLO 2.2 Carry out Survey to identify the problems of village community TLO 2.3 Unsertake Special camping about developmental programs TLO 2.4 Establish the liaisons between government and other developmental agencies for the implementations of various development schemes of Government	**MODULE II : National Service Scheme (NSS)** 2.1 Contacting Village/Area Leaders 2.2 Primary socio economic survey of few villages in the vicinity of the institute. 2.3 Selection of the village for adoption - conduct of activities 2.4 Comprehensive Socio Economic Survey of the Village/Area 2.5 Identification of Problem(s) 2.6 Dissemination of information about the latest developments in agriculture, watershed management, wastelands development, non-conventional energy, low cost housing, sanitation, nutrition and personal hygiene, schemes for skill development, income generation, government schemes, legal aid, consumer protection and allied fields. 2.7 A liaison between government and other development agencies for the implementation of various development schemes in the selected village / slum.	(i) The teachers should visit the village / slum before adopting it for NSS activities. (ii) The selected area should be compact. (iii) The community people should be receptive to the ideas of improving their living standard. They should also be ready to coordinate and involve in the projects undertaken by the NSS for their upliftment. (iv) The areas where political conflicts are likely to arise should be avoided by the NSS units. (v) The area should be easily accessible to the NSS volunteers to undertake frequent visits to slums.
3	TLO 3.1 Demonstrate Love and Compassion (Prem and Karuna) in the society TLO 3.2 Follow the path of Truth (Satya) TLO 3.3 Practice Non-Violence (Ahimsa) TLO 3.4 Follow the Righteousness (Dharma) TLO 3.5 Attain Peace (Shanti) in Life TLO 3.6 Provide Service (Seva) to the needy person/community. TLO 3.7 Demonstrate Renunciation (Sacrifice) Tyaga TLO 3.8 Practice Gender Equality and Sensitivity	**MODULE-III : Universal Human Values** 3.1 Love and Compassion (Prem and Karuna): Introduction, Practicing Love and Compassion (Prem and Karuna) 3.2 Truth (Satya) : Introduction, Practicing Truth (Satya) 3.3 Non-Violence (Ahimsa) : Introduction, Practicing Non-Violence (Ahimsa) 3.4 Righteousness (Dharma) : Introduction, Practicing Righteousness (Dharma) 3.5 Peace (Shanti) : Introduction, Practicing Peace (Shanti) 3.6 Service (Seva) : Introduction, Practicing Service (Seva) 3.7 Renunciation (Sacrifice) Tyaga : Introduction, Practicing Renunciation (Sacrifice) Tyaga 3.8 Gender Equality and Sensitivity: Introduction, Practicing Gender Equality and Sensitivity	i) Lectures ii) Demonstration iii) Case Study iv) Role Play v) Observations vi) Portfolio Writing vii) Simulation viii) Motivational talks by Practitioners ix) Site/Industry Visit

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Demonstrate Puntuality appropriately TLO 4.2 Practice Cleanliness, Hygiene and Orderliness for self and others TLO 4.3 Take Responsibility and Calculated Risks TLO 4.4 Demonstrate Gratitude and Appreciations TLO 4.5 Show Determination & Persistence about work TLO 4.6 Give Respect as per the social norms and practice TLO 4.7 Respect Team Spirit to the acceptable level TLO 4.8 Practice Caring & Sharing among fellow citizens/community TLO 4.9 Demonstrate Honesty	**MODULE-IV: Value Education (Unnati Foundation)** 4.1 Punctuality, Icebreaker and Simple Greeting, Understanding & Managing Emotions, Introducing Self, The power of a Positive Attitude, Talking about one's Family, Talking about one's Family, Making a Positive Impression, Give word list for a Word based 4.2 Cleanliness , Hygiene and Orderliness , Likes and Dislikes, Developing Confidence in Self and Others, Strengths and Weaknesses, Listening Skills , Greeting gestures, Gender Equality and Sensitivity 4.3 Responsibility, OCSEM- Visual Comprehension and Word Based Learning, Goal Setting – Make it happen, Follow, Like & Share Unnati Social Media - Facebook / Instagram/ Twitter Introducing Others, Time Management, Talking about the daily routine, Money Management 4.4 Gratitude and Appreciation , Asking Simple Questions & Asking for the price , Stress Management, Student Referral process ,Comprehending & Paraphrasing Information, A Plate of Rice and Dignity of Labour, Topics for Public Speaking, Placement Process , OCSEM-E-Newspaper, Critical Thinking to overcome challenges 4.5 Determination and Persistence, Guiding and Giving Directions, Language Etiquette & Mannerism, . Unnati Philosophy , b. Unnati Branding - Follow, Like & Share Unnati Social Media - Facebook / Instagram/ Twitter, Simple instructions to follow procedures, Assertiveness, Give topics for Debate, Describing a person/Objects, Refusal Skills, Word List for Word based Learning 4.6 Respect, Comparing , OCSEM - Public Speaking, Student referral process, Attending a phone call, Being a Good Team Player , Placement Process, At a Restaurant, Workplace ethics 4.7 Team Spirit, Inviting someone, OCSEM - Picture Reading & Word, a. Unnati Philosophy & b. Unnati Branding - Follow, Like & Share Unnati Social Media - Facebook / Instagram/ Twitter, Apologizing, Apologizing, Dealing effectively with Criticism, Introduce Importance of Self Learning and upskilling 4.8 Caring and Sharing , Handling Customer queries, Flexibility & Adaptibility, Student referral process, Writing a Resume, OCSEM-Public Speaking, Placement Process, Meditation/ Affirmation & OCSEM-Debate, Introduce Certif-ID, how to create Certif-ID Project , 4.9 Honesty, Email etiquette & Official Email communication, Alcohol & Substance use & abuse, Describing a known place ,	i) Video Demonstrations ii) Flipped Classroom iii) Case Study iv) Role Play v) Collaborative learning vi) Cooperative Learning vii) Chalk-Board

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
	TLO 4.10 Practice for Forgive and Forget	Leadership Skills, Describing an event, OSCEM-Picture Reading & Visual Comprehension 4.10 Forgive and Forget, Facing and Interview, OSCEM-Public Speaking , Attending a telephonic/Video interview & Mock Interview , Affirmation , Pat-a-Back & Closure (Valediction , Unnati Branding, Student Testimonials), Meditation/ Affirmation & Sponsor connect (Speak to UNXT HO)	
5	TLO 5.1 Develop Literacy About Savings and Investments in the community TLO 5.2 Attain Literacy About Financial Planning TLO 5.3 Demonstrate skills about Financial Transactions TLO 5.4 Use Literacy skills About Income, expenditure and budgeting TLO 5.5 Use measures about Inflation in the market. TLO 5.6 Use Literacy/Knowledge About Loans TLO 5.7 Explain the Importance of Insurance TLO 5.8 Follow Dos and Donts about finances	**MODULE-V : Financial Literacy** 5.1 Introduction - Life Goals and financial goals 5.2 Savings and Investments - Three pillars of investments, Popular asset classes, Government schemes, Mutual Funds, Securities markets (Shares and bonds), Gold, Real Estate, Do's and Don'ts of investments 5.3 Retirement planning 5.4 Cashless transactions 5.5 Income, expenditure and budgeting – Concepts and Importance 5.6 Inflation- Concept, effect on financial planning of an individual 5.7 Loans – Types, Management of loans, Tax benefits 5.8 Insurance – Types, Advantages, selection 5.9 Dos and Donts in Financial planning and Transactions	i) Online/Offline Mode of Instructions ii) Video Demonstrations iii) Presentations iv) Case Study v) Chalk-Board vi) Collaborative learning

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Suggestive list of activities during Regular as well as Special Camping (NSS Activities)

- Following list is only an illustrative list of the type of activities that can be undertaken. Under the programme it would be open to each NSS Unit to undertake one of these programmes or any other activity which may seem desirable to them according to local needs. The NSS Unit should aim at the integrated development of the area selected for its operation which could be a village or a slum. It has also to be ensured that at least a part of the programme does involve manual work.

(a) Environment Enrichment and Conservation:
The activities under this sub-theme would inter-alia, include:
(i) plantation of trees, their preservation and upkeep
(ii) Construction & maintenance of village streets, drains
(iii) Cleaning of village ponds and wells;

(iv) Popularization and construction of Gobar Gas Plants, use of non-conventional energy;
(v) Disposal of garbage & composting;
(vi) Prevention of soil erosion and work for soil conservation,
(vii) Watershed management and wasteland development
(viii) Preservation and upkeep of monuments, and creation of consciousness about the preservation of cultural heritage among the community.

(b) Health, Family Welfare and Nutrition Programme:

(i) Programme of mass immunization;
(ii) Working with people in nutrition programmes with the help of Home Science and medical college students;
(iii) Provision of safe and clean drinking water;
(iv) Integrated child development programmes;
(v) Health education, AIDS Awareness and preliminary health care.
(vi) Population education and family welfare programme;
(vii) Lifestyle education centres and counselling centres.
© Programmes aimed at creating an awareness for improvement of the status of women: (i) programmes of educating people and making them aware of women's rights both constitutional and legal;
(ii) creating consciousness among women that they too contributed to economic and social well-being of the community;
(iii) creating awareness among women that there is no occupation or vocation which is not open to them provided they acquire the requisite skills; and
(iv) imparting training to women in sewing, embroidery, knitting and other skills wherever possible.

(d) Social Service Programmes:

(i) work in hospitals, for example, serving as ward visitors to cheer the patients, help the patients, arranging occupational or hobby activities for long term patients; guidance service for out-door-patients including guiding visitors about hospital's procedures, letter writing and reading for the patients admitted in the hospital; follow up of patients discharged from the hospital by making home visits and places of work, assistance in running dispensaries etc.
(ii) work with the organisations of child welfare;
(iii) work in institutions meant for physically and mentally handicapped;
(iv) organising blood donation, eye pledge programmes;
(v) work in Cheshire homes, orphanages, homes for the aged etc.;
(vi) work in welfare organisations of women;
(vii) prevention of slums through social education and community action;

(e) Production Oriented Programmes:

(i) working with people and explaining and teaching improved agricultural practices;
(ii) rodent control land pest control practices;
(iii) weed control;
(iv) soil-testing, soil health care and soil conservation;
(v) assistance in repair of agriculture machinery;
(vi) work for the promotion and strengthening of cooperative societies in villages;
(vii) assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
(viii) popularisation of small savings and assistance in procuring bank loans

(f) Relief & Rehabilitation work during Natural Calamities:

(i) assisting the authorities in distribution of rations, medicine, clothes etc.;
(ii) assisting the health authorities in inoculation and immunisation, supply of medicine etc.;
(iii) working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;
(iv) assisting and working with local authorities in relief and rescue operation;
(v) collection of clothes and other materials, and sending the same to the affected areas;

(g) Education and Recreations: Activities in this field could include:

(i) adult education (short-duration programmes);
(ii) pre-school education programmes;
(iii) programmes of continuing education of school drop outs, remedial coaching of students from weaker sections;
(iv) work in crèches;
(v) participatory cultural and recreation programmes for the community including the use of mass media for instruction and recreation, programmes of community singing, dancing etc.;
(vi) organisation of youth clubs, rural land indigenous sports in collaboration with Nehru Yuva Kendras;
(vii) programmes including discussions on eradications of social evils like communalism, castism, regionalism, untouchability, drug abuse etc.;
(viii) non- formal education for rural youth and
(ix) legal literacy, consumer awareness.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Simple engineering measurement devices GPS data collection tools GIS open source softwares- Google Earth and QGIS MS office suite	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table) : NOT APPLICABLE

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Formative assessment (Assessment for Learning) Report and presentation of fieldwork activities, Self-Learning (Assignment)

Summative Assessment (Assessment of Learning)

XI. 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					03	03	03			
CO2					02	02	03			
CO3	01	01	01		03	03	03			
CO4		01	01	01	03	03	03			
CO5		02		01	03	03	03			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	IRAP, Hyderabad, CTARA, IIT Bombay and UNICEF, Mumbai	Compendium of Training Materials for the Capacity Building of the Faculty and Students of Engineering Colleges on 'IMPROVING THE PERFORMANCE OF RURAL WATER SUPPLY AND SANITATION SECTOR IN MAHARASHTRA' Districts Economic survey reports	UNICEF
2	Central Public Health and Environmental Engineering Organisation	Manual on Water Supply and Treatment	Ministry of Urban Development, New Delhi
3	Specifications And Standards Committee	Indian Standards (IS) Codes and Indian Roads Congress (IRC) Codes	Bureau of Indian Standards and The Indian Road Congress
4	Prepared by each district administration	Districts Economic survey reports	Govt. of Maharashtra

Sr.No	Author	Title	Publisher with ISBN Number
5	Local college students, UMA staffs	Sample Case Studies on UMA website	IITB-UMA team
6	RBI	https://www.rbi.org.in/FinancialEducation/content/GUIDE310113_F.pdf	RBI
7	RBI	https://www.rbi.org.in/FinancialEducation/content/Financing%20needs%20of%20Micro%20and%20small%20Enterprises%20-%20A%20guide.pdf	RBI
8	RBI	https://www.rbi.org.in/FinancialEducation/content/I%20Can%20Do_RBI.pdf	RBI

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201601131501523808.pdf	Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan
2	https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201606151454073708.pdf	Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan Guidelines
3	https://censusindia.gov.in/census.website/	A Website of Census of India
4	https://gsda.maharashtra.gov.in/english/	A Website of Groundwater Survey and Development Agency, GoM
5	https://mrsac.gov.in/MRSAC/map/map	A Website where district-wise maps showcasing different attributes developed by Maharashtra Remote Sensing Applications Centre.
6	https://ejalshakti.gov.in/jjmreport/JJMIndia.aspx	A Website of Jal Jivan Mission, Government of India
7	https://cpcb.nic.in/	A Website of Central Pollution Control Board, Government of India
8	http://www.mahapwd.com/#	A Website of Public Works Department, GoM
9	http://tutorial.communitygis.net/	A Website for GIS data sets developed by Unnat Maharashtra Abhiyan
10	https://youtu.be/G71maumVZ1A?si=TzDTxKUpLYaRos7U	A video record of lecture by Prof. Milind Sohoni, IIT Bombay, on Engineering, Development and Society
11	https://youtu.be/TUcPNwtdKyE?si=wnSWrhGc9dJTC-ac	A keynote talk by Prof. Milind Sohoni, IIT Bombay, on Interdisciplinary Engineering: The Road Ahead
12	https://youtu.be/mKJj6j_1gWg?si=ajE8s4lfB2OM63Ng	A TED talk by Prof. Milind Sohoni, IIT Bombay, on Vernacular Science: The Science of Delivery
13	https://www.ugc.gov.in/pdfnews/4371304_LifeSKill_JeevanKaushal_2023.pdf	UHV: UGC Course on life skils. Unit 4 i.e. Course 4 is to be referred
14	https://nss.gov.in/	NSS : Know about the NSS Scheme and details
15	https://www.rbi.org.in/FinancialEducation/FinancialEnterprenure.aspx	Reference for Module V
16	https://www.rbi.org.in/FinancialEducation/content/I%20Can%20Do_RBI.pdf	Reference for Module V

Sr.No	Link / Portal	Description
17	https://www.rbi.org.in/FinancialEducation/content/Financing%20needs%20of%20Micro%20and%20small%20Enterprises%20-%20A%20guide.pdf	Reference for Module V
18	https://www.rbi.org.in/FinancialEducation/content/GUIDE310113_F.pdf	Reference for Module V