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ENGINEERING MECHANICS **Course Code : 312312**

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 components using principles of mechanics enable to fetch the relevant data for detailing with design of structure/machine. The analysis of forces helps to prevent the defects, errors and subsequent failures arising in such elements under the action of forces. This course is designed for diploma aspirants to acquire and apply the basic discipline knowledge to solve the practical problems related with the design and detailing of components related to civil, mechanical, agricultural engineering etc.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply the principles of engineering mechanics to solve the given engineering problem(s)

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 lamina.

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

ENGINEERING MECHANICS **Course Code : 312312**

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.
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 of machine for the given loading condition. 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

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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 given type of force. TLO 2.2 Calculate the moment of forces in a given 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 analytically the resultant of given force system. TLO 2.6 Calculate graphically the resultant of given force system	**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
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 loading and beam in a given structure. TLO 3.5 Determine analytically the reactions in the given type of beam.	**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 having not more than two unknown.) 3.4 Types of supports: fixed, simple, hinged and roller. Types of beams: cantilever, simply supported, overhanging, continuous and fixed. Types of loads: vertical and inclined point load, uniformly distributed load (UDL). 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 of loading).	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 Draw FBD and analyze it for equilibrium of bodies on inclined plane in the given situation. TLO 4.4 Draw free body diagram for showing forces acting on a ladder under given condition.	**Unit - IV Friction** 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 (Pull and Push) 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

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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 L, T, I, C, Z sections consisting of 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 Identify the relevant component of IKS from the given content.	1	Collect the photographic information of Indian knowledge system (IKS) given in various unit	2	CO1 CO2 CO5
LLO 2.1 Use the Differential Axle & Wheel to calculate relevant parameters under different loading condition.	2	*Determine mechanical advantage and velocity ratio of differential axle and wheel for different loading conditions.	2	CO1
LLO 3.1 Use the worm and worm wheel to calculate relevant parameters under different loading condition.	3	Determine mechanical advantage and velocity ratio of worm and worm wheel for different loading conditions.	2	CO1
LLO 4.1 Use the single or Double purchase crab winch to calculate relevant parameters under different loading condition.	4	Determine mechanical advantage and velocity ratio of single or Double purchase crab winch for different loading conditions.	2	CO1
LLO 5.1 Use the simple screw jack to calculate relevant parameters under different loading condition.	5	*Determine mechanical advantage and velocity ratio of simple screw jack for different loading conditions.	2	CO1
LLO 6.1 Use the Weston’s differential pulley block to calculate relevant parameters under different loading condition.	6	Determine mechanical advantage and velocity ratio of Weston’s differential pulley block for different loading conditions.	2	CO1
LLO 7.1 Use the geared pulley block to calculate relevant parameters under different loading condition.	7	Determine mechanical advantage and velocity ratio of geared pulley block for different loading conditions.	2	CO1
LLO 8.1 Use the two or three sheave pulley block to calculate relevant parameters under different loading condition.	8	Determine mechanical advantage and velocity ratio of two or three sheave pulley block for different loading conditions.	2	CO1
LLO 9.1 Use the universal force table to verify the law of polygon.	9	*Verify law of polygon of forces using Universal force table for given forces.	2	CO2
LLO 10.1 Use moment apparatus to verify the law of moment.	10	*Verify law of moment of forces using law of moment apparatus for given forces.	2	CO2
LLO 11.1 Use universal force table to verify the Lami's theorem.	11	*Verify the Lami's theorem using Universal force table apparatus for given forces.	2	CO3
LLO 12.1 Use the beam reaction apparatus to determine support reactions of the given simply supported beam.	12	*Determine support reactions of simply supported beam using beam reaction apparatus for given vertical loading.	2	CO3

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 13.1 Use the horizontal plane friction apparatus for the given body to calculate coefficient of friction.	13	*Determine coefficient of friction using friction apparatus for given block on horizontal plane.	2	CO4
LLO 14.1 Use the inclined plane friction apparatus for the given body to calculate coefficient of friction.	14	Determine coefficient of friction using friction apparatus for given block on inclined plane.	2	CO4
LLO 15.1 Prepare a simple paper model of the given lamina to determine its centroid.	15	*Verify centroid of given plane lamina of 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)

Micro project

- 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 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.
• 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.).
• Collect minimum Ten sample of materials having different coefficient of friction.
• Prepare a chart showing comparison of centroid and center of gravity for square-cube, rectangle-cylinder, triangle-cone, circle-sphere, semicircle-hemisphere.
• Prepare a models of solids like square, rectangle triangle, circle, semicircle, cube, cuboid, cylinder, cone, sphere, hemisphere.

Assignment

- Solve the examples on calculation of values of MA, VR, Pi, Pf, Wi, Wf, law of machine etc. for given type of machine.

• Solve the examples on calculation of orthogonal or non-orthogonal components of a force.
• Solve the examples on calculation of moments of a force from given problem statement or figure.
• Solve the examples on calculation of resultant for given force system from given problem statement or figure.
• 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 coefficient of friction, normal reaction, force required to pull or push the block for given case of frictional bodies (horizontal or inclined plane).
• Solve the examples on calculation of centroid of simple/composite plane figures from given problem statement or figure.
• Solve the examples on calculation of center of gravity for simple/composite solid bodies from given problem statement or figure.

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Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

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	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
3	Beam Reaction apparatus (The apparatus is with two circular dial type 10 kg.)	15
4	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
5	Models of geometrical figures.	18
6	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
7	Worm and worm wheel (wall mounted unit with threaded spindle, load drum, effort wheel; with necessary slotted weights, hanger and thread)	3
8	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
9	Double Purchase Crab winch (Having assembly same as above but with double set of gearing arrangement.)	5
10	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
11	Weston's Differential pulley block (consisting of two pulleys; one bigger and other smaller.	7
12	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
13	Universal Force Table (Consists of a circular 40 cm dia. Aluminum disc, graduated into 360 degrees.) with all accessories.	9,14

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	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**

ENGINEERING MECHANICS **Course Code : 312312**

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://youtu.be/JnYVz1TSmBQ	Law of machine and types of machines useful in industry.
3	https://youtu.be/vWXIQYRXewc	Introduction to engineering mechanics

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Sr.No	Link / Portal	Description
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://youtu.be/iy8l6vUm0iw	System of Forces
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://youtu.be/L_ABGYA8HFA	Friction
10	https://youtu.be/ET3ioTDFpfA	Moment of Force
11	https://econtent.msbte.edu.in/econtent/econtent_home.php	Engineering Mechanics

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 01/10/2024 **Semester - 2, K Scheme**

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BUILDING MATERIAL AND CONSTRUCTION **Course Code : 312338**

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

BUILDING MATERIAL AND CONSTRUCTION **Course Code : 312338**

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.
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

BUILDING MATERIAL AND CONSTRUCTION **Course Code : 312338**

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
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

BUILDING MATERIAL AND CONSTRUCTION **Course Code : 312338**

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
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

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

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

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.

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Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	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
2	Bricks and blocks of different sizes.	4
3	Steel Tape	4,7,13,14,15
4	Weighing balance	4,7,8
5	Pan, spade	4,7,8
6	Painting brushes of different size for oil, acrylic painting and rollers of different size for smooth finishing work.	7
7	Paints-OBD, acrylic, plastic emulsion.	7
8	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
9	Ordinary Portland Cement, PPC	8
10	Portable Hammer,Spade, Pans (Ghamela), Thread, lime	9,10
11	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
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
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)

BUILDING MATERIAL AND CONSTRUCTION **Course Code : 312338**

- 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
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

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Sr.No	Link / Portal	Description
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

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 01/10/2024 **Semester - 2, K Scheme**

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SURVEYING **Course Code : 312339**

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

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SURVEYING **Course Code : 312339**

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.
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

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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

SURVEYING **Course Code : 312339**

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

SURVEYING **Course Code : 312339**

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 Height of Instrument method and Rise and Fall Method 4.5 Find the R.L. by Height of Instrument method with necessary checks (only Numerical question should be ask and no theory question). 4.6 Find the R.L by Rise and Fall method with necessary checks. (only Numerical question should be ask and no theory question). 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
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

SURVEYING **Course Code : 312339**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
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
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 area of 100m x 100m 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
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

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

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

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	Arrows 400 mm long and made up of good quality hardened and tempered steel wire of 4 mm in diameter.	1,2
3	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
4	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
5	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
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	Plane table with accessories- Plane and telescopic Alidade, Trough compass, U-fork ,Spirit level.	18,19,20,21
9	Digital planimeter of standard make with Ni Cd batteries and AC Adapters	3
10	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
11	Twenty Second Transit theodolite with accessories.	6,7,8,9

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

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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

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Sr.No	Link / Portal	Description
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

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 01/10/2024 **Semester - 2, K Scheme**