

Maharashtra State Board Of Technical Education, Mumbai																													
Learning and Assessment Scheme for Post S.S.C Diploma Courses																													
Programme Name		: Diploma In Automobile Engineering. / Mechanical Engineering / Mechatronics / Production Engineering																											
Programme Code		: AE / ME / MK / PG										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	Abbreviation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme						Credits	Paper Duration (hrs.)	Assessment Scheme										Total Marks					
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week	Theory			Based on LL & TL				Based on Self Learning		Total Marks									
						CL	TL	LL						FA-TH	SA-TH	Practical		SLA											
																FA-PR	SA-PR	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	ASC	DSC	312308	4	2	-	2	0	8	4	1.5	30	70*#	100	40	25	10	25@	10	-	-	200						
						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	MANUFACTURING TECHNOLOGY	MPR	DSC	312313	1	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175						
5	ENGINEERING DRAWING	EDG	SEC	312311	4	2	-	4	2	8	4	4	30	70	100	40	25	10	25@	10	25	10	175						
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					13	15	2	16	7	40	20		150	350	500		150		125		125		900						

Sr No	Course Title	Abbreviation	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
						CL	TL	LL					FA-TH	SA-TH	Total	Practical				SLA		
																FA-PR	SA-PR	SLA				
Max	Max	Max	Min	Max	Min	Max	Min	Max	Min													
<p>Abbreviations : CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment</p> <p>Legends : @ Internal Assessment, # External Assessment, *# On Line Examination , @\$ Internal Online Examination</p> <p>Note :</p> <ol style="list-style-type: none"> 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. <p>Course Category : Discipline Specific Course Core (DSC) : 3, Discipline Specific Elective (DSE) : 0, Value Education Course (VEC) : 1, Intern./Apprenti./Project./Community (INP) : 0, Ability Enhancement Course (AEC) : 1, Skill Enhancement Course (SEC) : 2, Generic Elective (GE) : 0</p> <p>♦ 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.</p>																						

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 & Telecommunication 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

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Course Code	Course Title	Abbr	Course Category/s	Learning Scheme						Credits	Paper Duration	Assessment Scheme										Total Marks
				Actual Contact Hrs./Week			SLH	NLH	Theory			Based on LL & TL				Based on SL						
				CL	TL	LL			Practical			FA-PR		SA-PR		SLA						
				Max	Max	Max	Max	Min	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.

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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.
1	<p>TLO 1.1 Explain physical quantities and its types with examples.</p> <p>TLO 1.2 Differentiate between scalar and vector quantities with examples.</p> <p>TLO 1.3 Apply dimensional analysis to check correctness of equation and conversion of units in different systems .</p> <p>TLO 1.4 Estimate the errors in the measurement for the give problem.</p> <p>TLO 1.5 Explain the working of ancient astronomical instruments to measure distance , time and hour angle .</p> <p>TLO 1.6 Explain the procedure of measuring the dimension of a given object by using vernier calipers and screw gauge .</p>	<p>Unit - I Units and Measurements</p> <p>1.1 Unit, physical quantities: fundamental and derived quantities and their units Systems of units: CGS, MKS and SI .</p> <p>1.2 Scalar and Vector Physical Quantities.</p> <p>1.3 Dimensions, dimensional formula ,Applications of dimensional analysis; correctness of physical equations ,conversion factor for interconversion of units in different systems of units.</p> <p>1.4 Errors, types of errors: instrumental, systematic and random error, estimation of errors: absolute, relative and percentage error, significant figures.</p> <p>1.5 Ancient astronomical instruments:Chakra, Dhanuryatra , Yasti and Phalaka yantra .</p> <p>1.6 Applications of Vernier calipers , Screw gauge .</p>	<p>Chalk and board Improved lecture, Tutorial Assignment Demonstration</p>
2	<p>TLO 2.1 Explain electric field, potential and potential difference.</p> <p>TLO 2.2 Explain magnetic intensity and flux with their units.</p> <p>TLO 2.3 Apply laws of series and parallel combination to the given electrical circuits.Explain the heating effect of electric current.</p> <p>TLO 2.4 Distinguish between conductors, semiconductors and insulators on the basis of energy bands.</p> <p>TLO 2.5 Explain the I-V characteristics and applications of p-n junction diode.</p>	<p>Unit - II Electricity, Magnetism and Semiconductors</p> <p>2.1 Concept of charge, Coulomb's inverse square law, Electric field, Electric field intensity, potential and potential difference.</p> <p>2.2 Magnetic field and magnetic field intensity and its units, magnetic lines of force, magnetic flux .</p> <p>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 .</p> <p>2.4 Conductors, Insulators and Semiconductors, Energy bands, intrinsic and extrinsic semiconductors, minority and majority charge carriers.</p> <p>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.</p>	<p>Chalk and board Improved lecture, Tutorial Assignment Demonstration Educational Games</p>

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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.
3	<p>TLO 3.1 Convert temperature in different temperature scales.</p> <p>TLO 3.2 Compare different modes of heat transfer with examples.</p> <p>TLO 3.3 Inter-relate the characteristics of the three gas laws.</p> <p>TLO 3.4 Inter-relate the characteristics of the three gas laws.</p> <p>TLO 3.5 Explain total internal reflection in optical fiber.</p> <p>TLO 3.6 Differentiate between types optical fiber with applications.</p>	<p>Unit - III Thermometry and Fiber Optics</p> <p>3.1 Heat, temperature, temperature scale: Degree Celsius, degree Kelvin, degree Fahrenheit.</p> <p>3.2 Modes of heat transfer: Conduction , Convection and Radiation , Applications in daily life .</p> <p>3.3 Boyle's law, Charle's law, Gay Lussac's law, perfect gas statements equations and simple numerical.</p> <p>3.4 Law of thermal conductivity ,Newton's law of cooling.</p> <p>3.5 Law of refraction, total internal reflection.</p> <p>3.6 Optical fiber: Principle, construction and working Types of Optical fibers;Single mode step index, Multimode step index, Multimode graded index Applications of optical fibers.</p>	<p>Chalk and board Improved lecture, Tutorial Assignment Demonstration Flip classroom Educational Games</p>
4	<p>TLO 4.1 Explain the properties of given material based on the bond formation.</p> <p>TLO 4.2 Describe the molecular structure of given solid, liquid and gases.</p> <p>TLO 4.3 Describe the crystal structure of the given solids.</p> <p>TLO 4.4 Explain Properties of metallic solid.</p>	<p>Unit - IV Chemical bonding</p> <p>4.1 Indian Chemistry:-Philosophy of atom by Acharya Kanad.</p> <p>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.</p> <p>4.3 Molecular arrangement in solid, liquid and gases.</p> <p>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.</p>	<p>Simulation, Model Display, Demonstration Chalk and board , PPT, ect</p>

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	<p>TLO 5.1 Describe mechanism of electrolysis of CuSO₄ solution by using cu and pt rods</p> <p>TLO 5.2 Solve numerical based on Faraday's first and second law of electrolysis.</p> <p>TLO 5.3 Distinguish between primary and secondary cell</p> <p>TLO 5.4 Describe the phenomenon of the given type of corrosion and its prevention.</p> <p>TLO 5.5 Identify the different factors affecting rate of corrosion for the given type of material.</p> <p>TLO 5.6 Select the protective measures to prevent the corrosion in the given corrosive medium.</p>	<p>Unit - V Electro chemistry and Metal Corrosion, its prevention</p> <p>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</p> <p>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.</p> <p>5.3 Difference between primary and secondary cell.</p> <p>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.</p> <p>5.5 Factors affecting the rate of corrosion.</p> <p>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</p>	<p>Simulation, Demonstration, Flipped Classroom, Collaborative Learning, Case Study, On-site/Industrial Visit ,chalk and board etc.</p>

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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.
6	<p>TLO 6.1 Identify the ingredients of the given paints.</p> <p>TLO 6.2 List out salient properties of the given paint and varnish.</p> <p>TLO 6.3 Describe the properties of insulating materials for the given application.</p> <p>TLO 6.4 Differentiate the given types of structural polymers.</p> <p>TLO 6.5 Describe the polymerization process of the given polymer.</p> <p>TLO 6.6 Explain the properties and uses of the given polymer, elastomer and adhesive.</p> <p>TLO 6.7 Describe the application of relevant adhesives required for the given material.</p> <p>TLO 6.8 Suggest the lubricant for various types of machines in industry.</p> <p>TLO 6.9 Select the relevant catalyst for given application.</p>	<p>Unit - VI Engineering Materials and Catalysis</p> <p>6.1 Paints: Purposes of applying paint, Characteristics of paints, Ingredients of paints, Function and examples of each ingredient.</p> <p>6.2 Varnish: Types, Difference between paint and varnishes.</p> <p>6.3 Insulators: Characteristics, Classification, Properties and Application of Glass wool Thermocol.</p> <p>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).</p> <p>6.5 Types Polymerization Reaction, Addition Polymerization, Condensation Polymerization, Synthesis, properties and application of Polyethylene, Polyvinyl chloride, Teflon, Polystyrene, Phenol formaldehyde, Epoxy Resin.</p> <p>6.6 Adhesives: Characteristics, Classification and their uses</p> <p>6.7 Lubricants: Classification, properties and Applications.</p> <p>6.8 Catalysis: Types of catalysis homocatalysis, heterocatalysis.</p> <p>6.9 Catalyst: Types of Catalyst Positive, Negative and Auto-catalyst, Catalytic Promoter and Catalytic inhibitor, Industrial application of catalyst.</p>	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
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

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

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
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
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 - <ul style="list-style-type: none"> • '*' 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 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, Charles'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.

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- 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 CuSO₄ solution by using Cu and Pt electrodes.
- Write properties and applications of solid, semisolid and liquid lubricant.

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 judicious 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.

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 ± 0.02 mm or better	2

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Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
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

BASIC SCIENCE

Course Code : 311305

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	Aryabhata.	The Surya Siddhanta	Baptist Mission press ,Calcutta
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

MSBTE Approval Dt. 09/08/2023

Semester - 1, K Scheme

BASIC SCIENCE**Course Code : 311305**

Sr.No	Author	Title	Publisher with ISBN Number
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	www.onlinelibrary.wiley.com	Materials and corrosion
12	www.rsc.org	Catalysis
13	www.chemcollective.org	Virtual Labs, simulation
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=chemistry&type=html,prototype	Identify states of matter of materials by using simulation.

MSBTE Approval Dt. 09/08/2023**Semester - 1, K Scheme**

PROFESSIONAL COMMUNICATION**Course Code : 312002**

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

PROFESSIONAL COMMUNICATION

Course Code : 312002

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme										Total Marks
				Actual Contact Hrs./Week			SLH	NLH			Theory			Based on LL & TL				Based on SL			
				CL	TL	LL					Practical			SLA							
											FA-TH	SA-TH	Total	FA-PR	SA-PR	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.
1	<p>TLO 1.1 Describe the importance of professional communication in given situations</p> <p>TLO 1.2 Identify the types of communication barriers in given situations and suggestive remedies</p> <p>TLO 1.3 Use different types of verbal and non-verbal communication for the given situation</p>	<p>Unit - I Professional Communication : An Overview</p> <p>1.1 Definition of professional communication- Importance, relevance, Elements and process of communication</p> <p>1.2 7 C's of Professional Communication (Clarity, Conciseness, correctness, Coherent, concrete, courteous and Complete)</p> <p>1.3 Types –Verbal (Oral-Written), Formal, Informal (Grapevine), Vertical</p> <p>1.4 Barriers to communication, Types of barriers (Linguistic, Psychological, Technological)</p>	<p>Language lab</p> <p>Role plays</p> <p>Chalk board</p> <p>Reference books</p> <p>Case studies</p>
2	<p>TLO 2.1 Identify the difference between listening and hearing</p> <p>TLO 2.2 Differentiate the types of listening in various situations</p> <p>TLO 2.3 Take notes during lectures, seminars . Make use of types of note taking and note making for different subjects / topics</p>	<p>Unit - II Listening & Note Taking</p> <p>2.1 Difference between listening & Hearing</p> <p>2.2 Types of listening a)Active listening b)Passive listening c)Selective listening</p> <p>2.3 Techniques of Note taking , Types of note taking (Outline notes, Mind Mapping, Flowcharts)</p>	<p>Language Lab</p> <p>Classroom learning</p> <p>NPTTEL</p> <p>Role Play</p>

PROFESSIONAL COMMUNICATION**Course Code : 312002**

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 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
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
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

PROFESSIONAL COMMUNICATION

Course Code : 312002

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

- '*1' 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 :

- 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.

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**

MSBTE Approval Dt. 29/11/2023

Semester - 2, K Scheme

PROFESSIONAL COMMUNICATION

Course Code : 312002

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
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

SOCIAL AND LIFE SKILLS

Programme Name/s	: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural En Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fas Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical En Electronics & Tele-communication Engg./ Electrical Power System/ Electronics & Communic Engineering/ Food Technology/ Computer Hardware & Maintenance/ Hotel Management & Catering Tech Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technolog Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechani 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. S skills that are needed for successful, healthy relationships to easily adapt when moving from one social situation to the next. Th effectively and develop enduring, supportive relationships, we're happier and healthier. This is why developing life skills and eventua to being successful in life, it's key for our health and well-being. Thus, Teaching of Social and life skills provide students with essenti attitudes, values, morals ,social skills and better equip them to handle stress and build their self efficacy, self esteem and self confiden

Note : The course offers five different alternatives(modules) for achieving above outcomes . Students must complete any one mo options.

- MODULE-I : Unnat Maharashtra Abhiyan (UMA)
- MODULE-II : National Service Scheme (NSS)
- MODULE-III : Unniversal Human Values
- MODULE-IV: Value Education (Unnati Foundation)
- 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 requ 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

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	Paper Duration	Assessm			
				Actual Contact Hrs./Week			SLH	NLH			Theory			
				CL	TL	LL					FA-TH	SA-TH	Total	
				Max	Max	Max	Max	Min			Min			
312003	SOCIAL AND LIFE SKILLS	SFS	VEC	-	-	-	2	2	1	-	-	-	-	

SOCIAL AND LIFE SKILLS**Total IKS Hrs for Sem. : Hrs**

Abbreviations: CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notion 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"
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 do 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
1	<p>TLO 1.1 Explain developmental needs and connection of various stakeholders</p> <p>TLO 1.2 Enlist the local problems</p> <p>TLO 1.3 Design a methodology for fieldwork</p> <p>TLO 1.4 Select the attributes of engineering and social system for measurement, quantification, and documentation</p> <p>TLO 1.5 Measure & quantify the quantities / systems parameters</p> <p>TLO 1.6 Write a report using information collected tStudy the data collected from fieldwork and conclude the observations</p>	<p>MODULE I : Activities Under Unnat Maharashtra Abhiyan (UMA)</p> <p>1.1 Introduction to Societal Needs and respective stakeholders : Regional societal issues that need engineering intervention</p> <p>1.2 Multidisciplinary approach-linkages of academia, society and technology</p> <p>1.3 Stakeholders' involvement</p> <p>1.4 Introduction to Important secondary data sets available such as census, district economic surveys, cropping pattern, rainfall data, road network data etc</p> <p>1.5 Problem Outline and stakeholders : Importance of activity and connection with Mapping of system components and stakeholders (engineering / societal)</p> <p>1.6 Key attributes of measurement</p> <p>1.7 Various instruments used for data collection - survey templates, simple measuring equipments</p> <p>1.8 Format for measurement of identified attributes/ survey form and piloting of the same</p> <p>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</p> <p>1.10 Analysis and Report writing Report writing containing-</p> <ol style="list-style-type: none"> 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. 	<p>i) Group discuss ii) Role play iii) Case study iv) Seminar and</p> <p>Implementation</p> <p>The course will sessions and fie</p> <ol style="list-style-type: none"> a) Session I - In paradigm, field pedagogy b) Session II - V value creation, analysis and rep c) Session VIII feedback and as d) Field work - <ol style="list-style-type: none"> 1. Pilot Visit - F 2. Survey Visit Information Co 3. Survey Visit 4. Summary Vi <p>Methodology: Considering the designed, follow considered whi</p> <ol style="list-style-type: none"> i) Regroup in th conducting the group. ii) Assign a few this course to al iii) A group of c governance bod Corporations, V Parishads, Panc small technolog their area of wo iv) The group o out initial field possibilities of: where in studen measure / quant

SOCIAL AND LIFE SKILLS

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested
2	<p>TLO 2.1 Adopt a Village or Slum for providing needed services to the community</p> <p>TLO 2.2 Carry out Survey to identify the problems of village community</p> <p>TLO 2.3 Undertake Special camping about developmental programs</p> <p>TLO 2.4 Establish the liaisons between government and other developmental agencies for the implementations of various development schemes of Government</p>	<p>MODULE II : National Service Scheme (NSS)</p> <p>2.1 Contacting Village/Area Leaders</p> <p>2.2 Primary socio economic survey of few villages in the vicinity of the institute.</p> <p>2.3 Selection of the village for adoption - conduct of activities</p> <p>2.4 Comprehensive Socio Economic Survey of the Village/Area</p> <p>2.5 Identification of Problem(s)</p> <p>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.</p> <p>2.7 A liaison between government and other development agencies for the implementation of various development schemes in the selected village / slum.</p>	<p>(i) The teachers before adopting</p> <p>(ii) The selected</p> <p>(iii) The community receptive to the living standard.</p> <p>coordinate and undertaken by the</p> <p>(iv) The areas very likely to arise slums.</p> <p>(v) The area should have NSS volunteers to slums.</p>
3	<p>TLO 3.1 Demonstrate Love and Compassion (Prem and Karuna) in the society</p> <p>TLO 3.2 Follow the path of Truth (Satya)</p> <p>TLO 3.3 Practice Non-Violence (Ahimsa)</p> <p>TLO 3.4 Follow the Righteousness (Dharma)</p> <p>TLO 3.5 Attain Peace (Shanti) in Life</p> <p>TLO 3.6 Provide Service (Seva) to the needy person/community.</p> <p>TLO 3.7 Demonstrate Renunciation (Sacrifice) Tyaga</p> <p>TLO 3.8 Practice Gender Equality and Sensitivity</p>	<p>MODULE-III : Universal Human Values</p> <p>3.1 Love and Compassion (Prem and Karuna): Introduction, Practicing Love and Compassion (Prem and Karuna)</p> <p>3.2 Truth (Satya) : Introduction, Practicing Truth (Satya)</p> <p>3.3 Non-Violence (Ahimsa) : Introduction, Practicing Non-Violence (Ahimsa)</p> <p>3.4 Righteousness (Dharma) : Introduction, Practicing Righteousness (Dharma)</p> <p>3.5 Peace (Shanti) : Introduction, Practicing Peace (Shanti)</p> <p>3.6 Service (Seva) : Introduction, Practicing Service (Seva)</p> <p>3.7 Renunciation (Sacrifice) Tyaga : Introduction, Practicing Renunciation (Sacrifice) Tyaga</p> <p>3.8 Gender Equality and Sensitivity: Introduction, Practicing Gender Equality and Sensitivity</p>	<p>i) Lectures</p> <p>ii) Demonstrations</p> <p>iii) Case Study</p> <p>iv) Role Play</p> <p>v) Observations</p> <p>vi) Portfolio Work</p> <p>vii) Simulation</p> <p>viii) Motivational</p> <p>ix) Site/Industrial</p>

SOCIAL AND LIFE SKILLS

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested
4	<p>TLO 4.1 Demonstrate Punctuality appropriately</p> <p>TLO 4.2 Practice Cleanliness, Hygiene and Orderliness for self and others</p> <p>TLO 4.3 Take Responsibility and Calculated Risks</p> <p>TLO 4.4 Demonstrate Gratitude and Appreciations</p> <p>TLO 4.5 Show Determination & Persistence about work</p> <p>TLO 4.6 Give Respect as per the social norms and practice</p> <p>TLO 4.7 Respect Team Spirit to the acceptable level</p> <p>TLO 4.8 Practice Caring & Sharing among fellow citizens/community</p> <p>TLO 4.9 Demonstrate Honesty</p> <p>TLO 4.10 Practice for Forgive and Forget</p>	<p>MODULE-IV: Value Education (Unnati Foundation)</p> <p>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</p> <p>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</p> <p>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</p> <p>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</p> <p>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</p> <p>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</p> <p>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</p> <p>4.8 Caring and Sharing , Handling Customer queries, Flexibility & Adaptability, Student referral process, Writing a Resume, OCSEM-Public Speaking, Placement Process, Meditation/ Affirmation & OCSEM-Debate, Introduce Certif-ID, how to create Certif-ID Project ,</p> <p>4.9 Honesty, Email etiquette & Official Email communication, Alcohol & Substance use & abuse, Describing a known place , Leadership Skills, Describing an event, OSCEM-Picture Reading & Visual Comprehension</p> <p>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)</p>	<p>i) Video Demor</p> <p>ii) Flipped Clas</p> <p>iii) Case Study</p> <p>iv) Role Play</p> <p>v) Collaborativ</p> <p>vi) Cooperative</p> <p>vii) Chalk-Boar</p>

SOCIAL AND LIFE SKILLS

Sr.No	Theory Learning Outcomes (TLO's) aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested
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 ii) Video Demo iii) Presentation iv) Case Study v) Chalk-Board vi) Collaborative

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE**VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT****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 students to undertake any of these programmes or any other activity which may seem desirable to them according to local needs. The NSS Unit should aim at 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 in

(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 their 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 required skills;
- (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 activity, providing guidance service for out-door-patients including guiding visitors about hospital's procedures, letter writing and reading for the patient 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.;

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- (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 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 a
- (viii) non- formal education for rural youth and
- (ix) legal literacy, consumer awareness.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assign in similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired
- 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.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

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

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**

SOCIAL AND LIFE SKILLS

Course Outcomes (COs)	Programme Outcomes (POs)						
	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 Leadership
CO1					03	03	03
CO2					02	02	02
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
1	IRAP, Hyderabad, CTARA, IIT Bombay and UNICEF, Mumbai	Compendium of Training Materials for the Capacity Building of the Faculty and Students of Engineering Coll 'IMPROVING THE PERFORMANCE OF RURAL WATER SUPPLY AND SANITATION SECTOR IN MA Districts Economic survey reports
2	Central Public Health and Environmental Engineering Organisation	Manual on Water Supply and Treatment
3	Specifications And Standards Committee	Indian Standards (IS) Codes and Indian Roads Congress (IRC) Codes
4	Prepared by each district administration	Districts Economic survey reports
5	Local college students, UMA staffs	Sample Case Studies on UMA website
6	RBI	https://www.rbi.org.in/FinancialEducation/content/GUIDE310113_F.pdf
7	RBI	https://www.rbi.org.in/FinancialEducation/content/Financing%20needs%20of%20Micro%20and%20small%20A%20guide.pdf
8	RBI	https://www.rbi.org.in/FinancialEducation/content/I%20Can%20Do_RBI.pdf

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 Abhiyan
2	https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201606151454073708.pdf	Government Resolution of Government of 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
5	https://mrsac.gov.in/MRSAC/map/map	A Website where district-wise maps showcasing dif Maharashtra Remote Sensing Applications Centre.
6	https://ejalshakti.gov.in/jjmreport/JJMIndia.aspx	A Website of Jal Jivan Mission, Government of Indi
7	https://cpcb.nic.in/	A Website of Central Pollution Control Board, Gov
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 Ma

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Sr.No	Link / Portal	Description
10	https://youtu.be/G71maumVZ1A?si=TzDTxKUpLYaRos7U	A video record of lecture by Prof. Milind Sohoni, II Development and Society
11	https://youtu.be/TUcPNwtdKyE?si=wnSWrhGc9dJTC-ac	A keynote talk by Prof. Milind Sohoni, IIT Bombay Engineering: The Road Ahead
12	https://youtu.be/mKJj6j_1gWg?si=ajE8s4lfB2OM63Ng	A TED talk by Prof. Milind Sohoni, IIT Bombay, or Science of Delivery
13	https://www.ugc.gov.in/pdfnews/4371304_LifeSKill_JeevanKaushal_2023.pdf	UHV: UGC Course on life skills. Unit 4 i.e. Course
14	https://nss.gov.in/	NSS : Know about the NSS Scheme and details
15	https://www.rbi.org.in/FinancialEducation/FinancialEntrepreneur.aspx	Reference for Module V
16	https://www.rbi.org.in/FinancialEducation/content/I%20Can%20Do_RBI.pdf	Reference for Module V
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

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APPLIED MATHEMATICS

Course Code : 312301

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/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ 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/ Electronics & Computer Engg./
Programme Code	: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ MU/ PG/ TE/
Semester	: Second
Course Title	: APPLIED MATHEMATICS
Course Code	: 312301

I. RATIONALE

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

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

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

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Solve the broad-based engineering problems of integration using suitable methods.
- CO2 - Use definite integration to solve given engineering related problems.
- CO3 - Apply the concept of differential equation to find the solutions of given engineering problems.
- CO4 - Employ numerical methods to solve programme specific problems.
- CO5 - Use probability distributions to solve elementary engineering problems.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme						Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SL	LH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
				CL	TL	LL						Practical			SLA							
												FA-TH	SA-TH	Total	FA-PR	SA-PR	Max	Min	Max	Min		
312301	APPLIED MATHEMATICS	AMS	AEC	3	1	-	-	4	2	3	30	70	100	40	-	-	-	-	-	-	100	

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 Solve the given simple problem(s) based on rules of integration. TLO 1.2 Evaluate the given simple integral(s) using substitution method. TLO 1.3 Integrate given simple functions using the integration by parts. TLO 1.4 Solve the given simple integral by partial fractions.	Unit - I Indefinite Integration 1.1 Simple Integration: Rules of integration and integration of standard functions 1.2 Integration by substitution. 1.3 Integration by parts. 1.4 Integration by partial fractions (only linear non repeated factors at denominator of proper fraction).	Improved Lecture Demonstration Chalk-Board Presentations Video Demonstrations
2	TLO 2.1 Solve given examples based on Definite Integration. TLO 2.2 Use properties of definite integration to solve given problems.	Unit - II Definite Integration 2.1 Definite Integration: Definition, rules of definite integration with simple examples. 2.2 Properties of definite integral (without proof) and simple examples.	Video Simulation Chalk-Board Improved Lecture Presentations
3	TLO 3.1 Find the order and degree of given differential equations. TLO 3.2 Form simple differential equation for given elementary engineering problems. TLO 3.3 Solve given differential equations using the methods of Variable separable and Exact Differential Equation(Introduce the concept of partial differential equation). TLO 3.4 Solve given Linear Differential Equation.	Unit - III Differential Equation 3.1 Concept of Differential Equation. 3.2 Order, degree and formation of Differential equations 3.3 Methods of solving differential equations: Variable separable form, Exact Differential Equation, Linear Differential Equation.	Video Demonstrations Presentations Chalk-Board Improved Lecture Flipped Classroom

APPLIED MATHEMATICS

Course Code : 312301

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 Find roots of algebraic equations by using appropriate methods. TLO 4.2 Solve the system of equations in three unknowns by iterative methods. TLO 4.3 Solve problems using Bakhshali iterative method for finding approximate square root. (IKS)	Unit - IV Numerical Methods 4.1 Solution of algebraic equations: Bisection method, Regula falsi method and Newton –Raphson method. 4.2 Solution of simultaneous equations containing three Unknowns by iterative methods: Gauss Seidal and Jacobi's method. 4.3 Bakhshali iterative method for finding approximate square root. (IKS)	Video SCILAB Spreadsheet Chalk-Board Flipped Classroom Presentations
5	TLO 5.1 Solve given problems based on repeated trials using Binomial distribution. TLO 5.2 Solve given problems when number of trials are large and probability is very small. TLO 5.3 Utilize the concept of normal distribution to solve related engineering problems.	Unit - V Probability Distribution 5.1 Binomial distribution. 5.2 Poisson's distribution. 5.3 Normal distribution.	Video ORANGE Chalk-Board Improved Lecture Presentations

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 Integration by substitution	1	*Integration by substitution	1	CO1
LLO 2.1 Solve integration using by parts	2	*Integration by parts	1	CO1
LLO 3.1 Solve integration by partial fractions(only linear non repeated factors at denominator of proper fraction).	3	Integration by partial fractions.	1	CO1
LLO 4.1 Solve examples on Definite Integral based on given methods.	4	Definite Integral based on given methods.	1	CO2
LLO 5.1 Solve problems on properties of definite integral.	5	*Properties of definite integral	1	CO2
LLO 6.1 Solve given problems for finding the area under the curve and volume of revolution.	6	* #Area under the curve and volume of revolution.(Only for Civil and Mechanical Engineering Group)	1	CO2
LLO 7.1 Solve examples on mean value and root mean square value.	7	* #Mean value and root mean square value. (Only for Computer, Electrical and Electronics Engineering Group)	1	CO2
LLO 8.1 Solve examples on order, degree and formation of differential equation.	8	Order, degree and formation of differential equation.	1	CO3
LLO 9.1 Solve first order first degree differential equation using variable separable method.	9	Variable separable method.	1	CO3
LLO 10.1 Solve first order first degree differential equation using exact differential equation and linear differential equation.	10	*Exact differential equation and linear differential equation.	1	CO3

APPLIED MATHEMATICS**Course Code : 312301**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 11.1 Solve engineering application problems using differential equation.	11	*Applications of differential equations.(Take programme specific problems)	1	CO3
LLO 12.1 Solve problems on Bisection method and Regula falsi method.	12	*Bisection method and Regula falsi method.	1	CO4
LLO 13.1 Solve problems on Newton-Raphson method.	13	Newton- Raphson method.	1	CO4
LLO 14.1 Solve problems on Jacobi's method and Gauss Seidal Method.	14	Jacobi's method and Gauss Seidal Method.	1	CO4
LLO 15.1 Use Bakhshali iterative methods for finding approximate value of square root. (IKS)	15	*Bakhshali iterative methods for finding approximate value of square root. (IKS)	1	CO4
LLO 16.1 Solve engineering problems using Binomial distribution.	16	*Binomial Distribution	1	CO5
LLO 17.1 Solve engineering problems using Poisson distribution.	17	*Poisson Distribution	1	CO5
LLO 18.1 Solve engineering problems using Normal distribution.	18	Normal Distribution	1	CO5
LLO 19.1 Solve problems on Laplace transform and properties of Laplace transform.	19	* # Laplace transform and properties of Laplace transform.(Only for Electrical and Electronics Engineering Group)	1	CO2
LLO 20.1 Solve problems on Inverse Laplace transform and properties of Inverse Laplace transform.	20	* # Inverse Laplace transform and properties of Inverse Laplace transform.(Only for Electrical and Electronics Engineering Group)	1	CO2
Note : Out of above suggestive LLOs -				
<ul style="list-style-type: none"> • '* 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**

- NA

Assignment

- NA

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.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

APPLIED MATHEMATICS

Course Code : 312301

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Open-source software like wolfram alpha, SageMaths, MATHS3D, GeoGebra, Graph, DPLOT, and Graphing Calculator (Graph Eq2.13), 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	Indefinite Integration	CO1	15	2	6	12	20
2	II	Definite Integration	CO2	8	2	4	6	12
3	III	Differential Equation	CO3	8	2	4	6	12
4	IV	Numerical Methods	CO4	6	2	4	8	14
5	V	Probability Distribution	CO5	8	2	4	6	12
Grand Total				45	10	22	38	70

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Tests

Summative Assessment (Assessment of Learning)

- End Term 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	1	-	-	1	-	1			
CO2	3	1	-	-	1	-	1			
CO3	3	2	1	1	1	1	1			
CO4	2	3	2	2	1	1	1			
CO5	2	2	1	1	2	1	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -

*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

APPLIED MATHEMATICS**Course Code : 312301**

Sr.No	Author	Title	Publisher with ISBN Number
3	Kreyszig, 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
5	S. S. Sastry	Introductory Methods of Numerical Analysis	PHI Learning Private Limited, New Delhi. ISBN-978-81-203-4592-8
6	C. S. Seshadri	Studies in the History of Indian Mathematics	Hindustan Book Agency (India) P 19 Green Park Extension New Delhi. ISBN 978-93-80250-06-9
7	Marvin L. Bittinger David J. Ellenbogen Scott A. Sargent	Calculus and Its Applications	Addison-Wesley 10th Edition ISBN-13: 978-0-321-69433-1
8	Gareth James, Daniela Witten, Trevor Hastie Robert and Tibshirani	An Introduction to Statistical Learning with Applications in R	Springer New York Heidelberg Dordrecht London ISBN 978-1-4614-7137-0 ISBN 978-1-4614-7138-7 (eBook)

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	https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHoPig	Concept of Mathematics through video lectures and notes
3	https://www.wolframalpha.com/	Solving mathematical problems, performing calculations, and visualizing mathematical concepts.
4	http://www.sosmath.com/	Free resources and tutorials
5	http://mathworld.wolfram.com/	Extensive math encyclopedia with detailed explanations of mathematical concepts
6	https://www.mathsisfun.com/	Explanations and interactive lessons covering various math topics, from basic arithmetic to advanced
7	http://tutorial.math.lamar.edu/	Comprehensive set of notes and tutorials covering a wide range of mathematics topics.
8	https://www.purplemath.com/	Purplemath is a great resource for students seeking help with algebra and other foundational mathematics to improve learning.
9	https://www.brilliant.org/	Interactive learning in Mathematics
10	https://www.edx.org/	Offers a variety of courses
11	https://www.coursera.org/	Coursera offers online courses in applied mathematics from universities and institutions around the globe.
12	https://ocw.mit.edu/index.htm	The Massachusetts Institute of Technology (MIT) offers free access to course materials for a wide range of mathematical courses.

MSBTE Approval Dt. 29/11/2023**Semester - 2, K Scheme**

ENGINEERING DRAWING**Course Code : 312311**

Programme Name/s : Automobile Engineering./ Mechanical Engineering/ Mechatronics/ Production Engineering/
Programme Code : AE/ ME/ MK/ PG
Semester : Second
Course Title : ENGINEERING DRAWING
Course Code : 312311

I. RATIONALE

Engineering drawing lays the foundation for visualizing the situation and delivering the essential instructions, required to carry out engineering jobs. This course aims at developing the ability to read and draw projection of lines, planes, solids. It also aims at reading and drawing the sections of the orthographic views. Engineering drawing also intends to develop the ability to visualize and draw curves of intersection and develop lateral surfaces of various solids

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use different drawing instruments for solving broad based 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 - Apply principles of sectional orthographic projections for drawing given pictorial views.
- CO2 - Draw projection of lines and planes.
- CO3 - Draw projections of given solids for various orientations.
- CO4 - Interpret curves of intersection for given solids.
- CO5 - Draw development of lateral surfaces of various solids.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Paper Duration	Assessment Scheme										Total Marks
				Actual Contact Hrs./Week			SLH	NLH			Theory	Based on LL & TL				Based on SL					
				CL	TL	LL						Practical				SLA					
				Max	Max	Max	Min	Min				Max	Min	Max	Min	Max	Min				
312311	ENGINEERING DRAWING	EDG	SEC	2	-	4	2	8	4	4	30	70	100	40	25	10	25@	10	25	10	175

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.

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 Draw different types of sectional views. TLO 1.2 Draw sectioning and hatching conventions. TLO 1.3 Develop sectional orthographic views from the pictorial views of given object. TLO 1.4 Interpret the given drawing.	Unit - I Sectional Orthographic Views 1.1 Cutting plane line. 1.2 Types of sectional views: Full Section, half section, Partial or Broken section, Revolved section, removed section, offset section, aligned section. 1.3 Sectioning conventions. 1.4 Hatching or section lines. 1.5 Conversion of pictorial views into sectional orthographic views (complete object involving slots, threads, ribs, etc).	Model Demonstration Video Demonstrations
2	TLO 2.1 Draw different position of lines with respect to projection planes. TLO 2.2 Draw projection of lines in various positions according to the given condition. TLO 2.3 Draw various types of planes based on their orientation. TLO 2.4 Draw projection of planes in various orientations according to the given condition.	Unit - II Projection of Lines and Planes 2.1 Projection of straight lines involving following positions- i. Parallel to both the planes. ii. Perpendicular to one plane. iii. Inclined to one plane and parallel to the other plane. iv. Inclined to both the planes. 2.2 Traces of line. 2.3 Projection of planes involving following orientations- i. Plane parallel to one principal plane and perpendicular to the other plane. ii. Plane inclined to one principal plane and perpendicular to the other plane.	Model Demonstration Video Demonstrations
3	TLO 3.1 Draw projection of given regular solids. TLO 3.2 Draw projection of regular solids according to their orientation with planes. TLO 3.3 Interpret orientation of axis with respect to projection of planes of solids.	Unit - III Projection of Solids 3.1 Types of solids. 3.2 Projection of following solids- i. Regular polyhedron – Tetrahedron, Hexahedron (Cube) ii. Regular Prisms and Pyramids- Triangular, Square. iii. Regular solids of revolution- Cylinder, Cone. 3.3 Projection of given solids With Axis a. Perpendicular to one of the principal projection plane. b. Inclined to one of the principal plane and parallel to the other. c. Parallel to both principal planes.	Model Demonstration Video Demonstrations
4	TLO 4.1 Interpret intersection for the given solids. TLO 4.2 Draw curves of intersection of the given solid combination.	Unit - IV Intersection of Solids 4.1 Curves of intersection of surfaces - Prism with Prism (Triangular, Square), Cylinder with cylinder. 4.2 Curves of intersection of surfaces - Square Prism with Cylinder when – i. Axes are at 90° and bisecting. ii. Axes are at 90° and offset. 4.3 Curves of intersection of surfaces - Cylinder with Cone: when the axis of cylinder is parallel to both the reference planes and cone resting on base on HP with axis intersecting and offset from axis of cylinder.	Model Demonstration Video Demonstrations Hands-on of the intersecting solids

ENGINEERING DRAWING

Course Code : 312311

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 Draw development of lateral surfaces of the given solid. TLO 5.2 Identify parts where concept of development of the given surfaces is required. TLO 5.3 Draw development of given sheet metal.	Unit - V Development of Surfaces 5.1 Developments of lateral surfaces of cube, prisms (Triangular, Square), cylinder, pyramids (Triangular, Square), cone. 5.2 Applications of development of surfaces such as tray, funnel.	Model Demonstration Video Demonstrations Hands-on to develop lateral surface from the existing solids

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 Apply method of projection for drawing simple sectional orthographic views.	1	*Draw two problems on sectional orthographic projections (simple object) using first angle method of projection.	4	CO1
LLO 2.1 Apply method of projection for drawing simple sectional orthographic views.	2	*Draw two problems on sectional orthographic projections (object consisting of slot/rib/thread) using first angle method of projection.	4	CO1
LLO 3.1 Draw the projection of lines for the given positions of lines.	3	*Draw two problems on projection of lines showing the traces of line.	4	CO2
LLO 4.1 Draw the projection of planes for the given orientation of plane.	4	Draw two problems on projection of planes when plane is parallel to one principal plane and perpendicular to the other plane.	4	CO2
LLO 5.1 Draw the projection of planes for the given orientation of plane.	5	*Draw two problems on projection of planes when plane is inclined to one principal plane and perpendicular to the other plane.	4	CO2
LLO 6.1 Draw the projection of solids for the given position of plane.	6	*Draw any two problems on projection of solids with axis perpendicular to one of the principal projection planes.	4	CO3
LLO 7.1 Draw the projection of solids for the given position of plane.	7	*Draw any two problems on projection of solids with axis inclined to one of the principal plane and parallel to the other.	4	CO3
LLO 8.1 Draw the projection of solids for the given position of plane.	8	*Draw any two problems on projection of solids with axis parallel to both principal planes.	4	CO3
LLO 9.1 Draw the intersection of solids as per given situation.	9	Draw problems on intersection of solids when intersecting solids are -Prism with Prism, Cylinder with cylinder.	4	CO4
LLO 10.1 Draw the intersection of solids as per given situation.	10	*Draw problems on intersection of solids when intersecting solid is - Square Prism with Cylinder when . 1. Axes are at 90° and bisecting. 2. Axes are at 90° and offset.	4	CO4

ENGINEERING DRAWING**Course Code : 312311**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 11.1 Draw the intersection of solids as per given situation.	11	*Draw problems on intersection of solids when intersecting solids are Cylinder with Cone and the axis of cylinder is parallel to both the reference planes and cone resting on base on HP with axis intersecting and offset from axis of cylinder.	4	CO4
LLO 12.1 Draw the developments of lateral surfaces of given object.	12	Draw problems on developments of lateral surfaces of cube, prisms.	4	CO5
LLO 13.1 Draw the developments of lateral surfaces of given object.	13	*Draw problems on developments of lateral surfaces of cylinder, pyramids.	4	CO5
LLO 14.1 Draw the developments of lateral surfaces of given object.	14	*Draw problems on developments of lateral surfaces of tray, funnel.	4	CO5
LLO 15.1 Collect information of an ancient Indian culture related to engineering drawing.	15	*Prepare a report on the use of various solid geometrical shapes employed in ancient Indian constructions (IKS).	4	CO1 CO2 CO3 CO4 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**

- Sectional Orthographic projections. Minimum 5 problems
- Projection of Lines. Minimum 5 problems
- Projection of planes. Minimum 5 problems
- Projection of solids. One problem for each type of solids.
- Intersection of solids surfaces. One problem for each type of solids.
- Development of lateral surfaces of solids. One problem for each type of solids.

Micro project

- Student should collect fabricated job/component nearby workshop/industries/ and try to show curves of intersections for different solid surfaces.
- Each student will assess at least one sheet of other students (May be a group of 4 students identified by teacher can be taken) and will note down the mistakes committed by them. Student will also guide the students for correcting the mistakes, if any.
- Students should collect component, job/sample from nearby workshops/industries and try to show the development of lateral surfaces of that.
- Each student should explain at least one problem for construction and method of drawing in sheet. Teacher will assign the problem of particular sheet to be explained to each student.

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 judicious 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.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Drawing Table with Drawing Board of Full Imperial/ A1 size.	All
2	Models of objects for sectional orthographic.	1,2
3	Models/ Charts/ animated video of objects mentioned in unit no.2.	3,4,5
4	Models/charts/ animated video of projections of different solids.	6,7,8
5	Models/charts/ animated video of intersections of various solids.	9,10,11
6	Models/charts/ animated video of development of lateral surfaces of various solids.	12,13,14
7	Set of various industrial drawings being used by industries.	All
8	Drawing equipment and instruments for class room teaching-large size: T-square or drafter (Drafting Machine). Set squares (45°and 30°-60°) Protractor. Drawing instrument box (containing set of compasses and dividers). Drawing sheets, Drawing pencils, Eraser, Drawing pins / clips.	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	Sectional Orthographic Views	CO1	4	0	0	14	14
2	II	Projection of Lines and Planes	CO2	6	0	0	12	12
3	III	Projection of Solids	CO3	6	0	0	14	14
4	IV	Intersection of Solids	CO4	7	0	0	14	14
5	V	Development of Surfaces	CO5	7	0	0	16	16
Grand Total				30	0	0	70	70

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Continuous assessment based on process and product related performance indicators. Each practical will be assessed considering -60% weightage to process -40% weightage to product
- Tests

Summative Assessment (Assessment of Learning)

- End term exam- Theory
- End term exam- Practical (Lab Performance)

XI. SUGGESTED COS - POS MATRIX FORM

ENGINEERING DRAWING

Course Code : 312311

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	3	-	2	-	2	2			
CO2	3	3	-	2	-	2	2			
CO3	3	3	-	2	-	2	2			
CO4	3	3	2	2	-	2	2			
CO5	3	3	2	2	-	2	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	Bureau of Indian Standards.	Engineering Drawing Practice for Schools and Colleges IS: SP-46	Third Reprint, October 1998 ISBN No. 81-7061-091-2
2	Bhatt, N.D.	Engineering Drawing	Charotar Publishing House, 2010 ISBN No. 978-93-80358-17-8
3	Bhatt, N.D.; Panchal, V. M	Machine Drawing	Charotar Publishing House, 2010 ISBN No. 978-93-80358-11-6
4	Jolhe, D.A.	Engineering Drawing	Tata McGraw Hill Edu. New Delhi, 2010, ISBN No. 978-0-07-064837-1
5	Dhawan, R. K.	Engineering Drawing	S. Chand and Company New Delhi, ISBN No. 81-219-1431-0
6	Agrawal Basant , Agrawal C.M.	Engineering drawing	McGraw Hill Education ,New Delhi, ISBN No. 978-1259062889
7	Narayana, K.L., Kannaiah. P.	Engineering Drawing	Scitech PublicationsIndia, Chennai ISBN No-978-8183714433
8	Singhanian Nitin	Indian Art And Culture	McGraw Hill, ISBN No-978-9354601804

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/3VWnhRCF_0M	Sectional Orthographics
2	https://youtu.be/3WXPanCq9LI	Projection of lines
3	https://youtu.be/44glqyyw7OM	Projection of Plane
4	https://youtu.be/RE_ZG_SSsV8	Projection of solids
5	https://youtu.be/gIRsXiTKfDo	Projection of solids
6	https://youtu.be/q4uZYDtO05s	Projection of solids
7	https://youtu.be/rerGFp3V6W8	Intersection of solids
8	https://youtu.be/40pvNA0_sNM	Intersection of solids
9	https://youtu.be/P5oPrynRsTI	Development of lateral surfaces
10	https://youtu.be/vqk7SnpDQvg	Development of lateral surfaces

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 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	Paper Duration	Assessment Scheme										Total Marks
				Actual Contact Hrs./Week			SL	LH	NLH			Theory			Based on LL & TL				Based on SL			
				CL	TL	LL						FA-TH	SA-TH	Total	Practical		SLA					
							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.
1	<p>TLO 1.1 Identify the type of machine based on efficiency of machine.</p> <p>TLO 1.2 Calculate effort required and load lifted by the given simple lifting machine.</p> <p>TLO 1.3 Verify law machine for given loading.</p> <p>TLO 1.4 Determine effort required along with efficiency for given machine with varying velocity ratio.</p>	<p>Unit - I Simple Lifting Machine</p> <p>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)</p> <p>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.</p> <p>1.3 Nature of graphs: Load vs. effort, load vs. ideal effort, load vs. MA, load vs. efficiency, Law of machine and its uses.</p> <p>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.</p>	<p>Chalk-Board</p> <p>Video</p> <p>Demonstrations</p> <p>Presentations</p> <p>Demonstration</p> <p>Hands-on</p> <p>Case Study</p>

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	<p>TLO 2.1 Describe the characteristics of force.</p> <p>TLO 2.2 Calculate the moment of given forces in a force system.</p> <p>TLO 2.3 Suggest the suitable law for the analysis of given force system.</p> <p>TLO 2.4 Determine the components of given force.</p> <p>TLO 2.5 Calculate the resultant force of given force system analytically.</p> <p>TLO 2.6 Calculate the resultant force of given force system graphically.</p>	<p>Unit - II Analysis of Forces</p> <p>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</p> <p>2.2 Moment of force: Definition, unit, sign conventions, couple and its properties.</p> <p>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)</p> <p>2.4 Resolution of coplanar forces: orthogonal and non orthogonal components of a force.</p> <p>2.5 Composition of coplanar forces using analytical method. Resultant of collinear, concurrent and non-concurrent force system.</p> <p>2.6 Composition of coplanar forces using graphical method. Resultant of concurrent force system and parallel force system consisting of maximum four forces only.</p>	<p>Chalk-Board</p> <p>Video</p> <p>Demonstrations</p> <p>Collaborative learning</p> <p>Presentations</p> <p>Hands-on</p> <p>Case Study</p>
3	<p>TLO 3.1 Draw the Free Body Diagram for given loading in given situation.</p> <p>TLO 3.2 Determine the equilibrant of the given concurrent force system.</p> <p>TLO 3.3 Use Lami's theorem to determine the unknown forces causing equilibrium for given practical situation.</p> <p>TLO 3.4 Identify the type of beam in a given structure.</p> <p>TLO 3.5 Determine reactions in the given type of beam analytically.</p>	<p>Unit - III Equilibrium of Forces</p> <p>3.1 Equilibrium and its conditions.</p> <p>3.2 Equilibrant and relation with resultant, Equilibrant of concurrent force system.</p> <p>3.3 Lami's Theorem and its applications, Concept of Free body diagram, (Problems unknown not more than two.)</p> <p>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.</p> <p>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).</p>	<p>Chalk-Board</p> <p>Video</p> <p>Demonstrations</p> <p>Presentations</p> <p>Site/Industry Visit</p> <p>Hands-on</p> <p>Case Study</p>
4	<p>TLO 4.1 Determine friction force along with coefficient of friction for the given condition.</p> <p>TLO 4.2 Describe the conditions for friction for the give situation.</p> <p>TLO 4.3 Determine friction force in the given situation.</p> <p>TLO 4.4 Draw free body diagram for showing forces acting on a ladder under given condition.</p>	<p>Unit - IV Friction of Forces</p> <p>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.</p> <p>4.2 Equilibrium of bodies on level surface subjected to force parallel to plane and inclined to plane.</p> <p>4.3 Equilibrium of bodies on inclined plane subjected to force parallel to the plane only.</p> <p>4.4 Forces acting on ladder (only free body diagram, no numerical).</p>	<p>Chalk-Board</p> <p>Video</p> <p>Demonstrations</p> <p>Presentations</p> <p>Demonstration</p> <p>Case Study</p> <p>Hands-on</p>

ENGINEERING MECHANICS**Course Code : 312312**

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
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

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
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
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 - <ul style="list-style-type: none"> *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, η , P_i , P_f , W_i , W_f 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.

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- 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 :

- 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 judicious 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.

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 in steps 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 in steps 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
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
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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

MSBTE Approval Dt. 29/11/2023

Semester - 2, K Scheme

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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_rLjv-MY&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT&index=3	Introduction of force system with examples
5	https://www.youtube.com/watch?v=Fudcc0JoXdo&list=PLOSWwFV98rfKXq2KBphJz95rao7q8PpwT&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=wfjLNSfPXA	Centroid of plane/composite figures, C.G. of plane/composite solids
10	https://www.youtube.com/watch?v=v6VTMwxx4oA	Centroid of composite figures.

MSBTE Approval Dt. 29/11/2023**Semester - 2, K Scheme**

MANUFACTURING TECHNOLOGY**Course Code : 312313**

Programme Name/s : Automobile Engineering./ Mechanical Engineering/ Mechatronics/ Production Engineering/
Programme Code : AE/ ME/ MK/ PG
Semester : Second
Course Title : MANUFACTURING TECHNOLOGY
Course Code : 312313

I. RATIONALE

Diploma graduates frequently encounter diverse manufacturing processes. This core manufacturing technology course aims to enhance student's comprehension of manufacturing methods, like turning, drilling, milling, casting, forming, and joining, etc.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Produce a given component using various manufacturing processes.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Produce a part using a lathe and drilling machine as per given drawing.
- CO2 - Produce a part using a milling machine as per given drawing.
- CO3 - Produce a part using casting processes as per given drawing.
- CO4 - Produce a part using forming processes as per given drawing.
- CO5 - Produce a part using joining processes as per given drawing..

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme						Credits	Paper Duration	Assessment Scheme										Total Marks
				Actual Contact Hrs./Week	CL	TL	LL	SLH	NLH			Theory			Based on LL & TL				Based on SL			
												Practical			FA-PR		SA-PR		SLA			
												FA-TH	SA-TH	Total	Max	Min	Max	Min	Max	Min	Max	
312313	MANUFACTURING TECHNOLOGY	MPR	DSC	3	-	4	1	8	4	3	30	70	100	40	25	10	25@	10	25	10	175	

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

MANUFACTURING TECHNOLOGY

Course Code : 312313

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	<p>TLO 1.1 List various angles of single point cutting tool.</p> <p>TLO 1.2 List accessories of lathe machine and their function.</p> <p>TLO 1.3 Calculate machining parameters for given component.</p> <p>TLO 1.4 Describe construction and specification of a drilling machine.</p> <p>TLO 1.5 List various drilling operations</p>	<p>Unit - I Fundamentals of Lathe and drilling machines</p> <p>1.1 Basics of Machining: Single point cutting Tool and its nomenclature, Mechanics of Chip formation, Types of Chips.</p> <p>1.2 Lathe machine: Classification, specification of centre lathe; Basic parts and accessories like chucks (three jaw, four jaw, and magnetic chuck), mandrels, rests, faceplate, centres and angle plate of centre lathe and their functions.</p> <p>1.3 Lathe operations: facing, plain turning, taper turning, thread cutting, chamfering, grooving, knurling and cutting parameters like speed, feed, depth of cut and machining time.</p> <p>1.4 Drill machine: Classification, specification of drilling machine Basic parts of radial drilling machine, Sensitive drilling and their function.</p> <p>1.5 Drilling machine operations: Drilling, reaming, boring, counter sinking, counter boring, spot facing and Cutting parameters- speed, feed, depth of cut and machining time.</p>	<p>Model Demonstration Video Demonstrations</p>
2	<p>TLO 2.1 Demonstrate working of milling machines.</p> <p>TLO 2.2 Select appropriate milling cutter for given component.</p> <p>TLO 2.3 Describe milling operations for given component.</p> <p>TLO 2.4 Illustrate procedure of indexing methods.</p>	<p>Unit - II Milling Machines</p> <p>2.1 Milling Machine: Working principle, types of milling machines.</p> <p>2.2 Milling cutter: Different types of cutters, face milling cutters end milling cutters, staggered tooth milling cutter, side and face milling cutter, form milling cutters and metal slitting saw.</p> <p>2.3 Milling Process: Plain milling, face milling, side milling, end milling, straddle milling, gang milling, up and down milling.</p> <p>2.4 Dividing head; Types, function of dividing head, method of indexing.</p>	<p>Model Demonstration Video Demonstrations</p>
3	<p>TLO 3.1 Describe significance of pattern allowances.</p> <p>TLO 3.2 Describe moulding methods.</p> <p>TLO 3.3 Classify casting processes.</p> <p>TLO 3.4 Enumerate safety guidelines and precautions for a foundry workshop.</p>	<p>Unit - III Casting processes</p> <p>3.1 Pattern making: Basic steps in making pattern, types, materials and allowances, Color coding of pattern.</p> <p>3.2 Moulding: Types and properties of moulding sands, moulding methods, cores and core prints, gating and risering system.</p> <p>3.3 Casting: Casting in Indus valley civilization (IKS), Centrifugal casting, investment casting, shell moulding and applications, Casting defects-causes and remedies.</p> <p>3.4 Safety practices/ precautions in foundry shop.</p>	<p>Chalk-Board Model Demonstration Video Demonstrations</p>
4	<p>TLO 4.1 Select the relevant forming process for given component.</p> <p>TLO 4.2 Differentiate rolling and forging process.</p> <p>TLO 4.3 List various press tool operations for given component.</p> <p>TLO 4.4 Enumerate safety guidelines and precautions for a forging/press shop</p>	<p>Unit - IV Forming processes</p> <p>4.1 Drop forging: Introduction to forging, upset forging, Press forging, open die and closed die forging operations.</p> <p>4.2 Rolling: Principle of rolling, hot and cold rolling and applications, rolling mill.</p> <p>4.3 Press tool: Various operations performed on press, press tool, simple, progressive and forming dies and applications.</p> <p>4.4 Safety practices/ precautions in forging and press shop.</p>	<p>Chalk-Board Model Demonstration</p>

MANUFACTURING TECHNOLOGY

Course Code : 312313

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	<p>TLO 5.1 Select suitable welding process for given component.</p> <p>TLO 5.2 Describe gas welding process.</p> <p>TLO 5.3 Differentiate various arc welding processes.</p> <p>TLO 5.4 Compare soldering and brazing process.</p> <p>TLO 5.5 List causes of welding defects and suggest remedies.</p> <p>TLO 5.6 Enumerate safety guidelines and precautions for a welding shop.</p>	<p>Unit - V Metal joining processes</p> <p>5.1 Welding Processes: welding and weldability, types and classification of welding processes.</p> <p>5.2 Gas welding: gas welding equipments, oxy-acetylene welding, types of flame.</p> <p>5.3 Arc welding: arc welding equipment equipments, flux shielded metal arc welding, TIG and MIG welding.</p> <p>5.4 Soldering and brazing process, Comparison, fillers, merits, demerits and applications.</p> <p>5.5 Defects in welding joints: causes and remedies.</p> <p>5.6 Safety practices/ precautions in welding shop.</p>	Chalk-Board Demonstration

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
<p>LLO 1.1 Setup a lathe machine for given job as per operations.</p> <p>LLO 1.2 Select suitable cutting parameters for operations as per given job.</p> <p>LLO 1.3 Prepare a turning job as per given drawing.</p>	1	*Produce a job on a lathe machine that comprises facing, plain turning and step turning operations as per the given drawing.	4	CO1
<p>LLO 2.1 Setup a lathe machine for taper turning operations.</p> <p>LLO 2.2 Calculate taper angle for taper turning operations as per given job.</p> <p>LLO 2.3 Prepare a taper turning job as per given drawing.</p>	2	*Produce a job on a lathe machine that comprises taper turning and grooving operations as per the given drawing.	4	CO1
<p>LLO 3.1 Setup a lathe machine for chamfering and knurling operations.</p> <p>LLO 3.2 Select suitable cutting parameters for chamfering and knurling operations.</p> <p>LLO 3.3 Prepare a chamfering and knurling job as per given drawing.</p>	3	*Produce a job on a lathe machine that comprises knurling and chamfering operations as per the given drawing.	4	CO1
<p>LLO 4.1 Setup a drill machine for given job as per operations.</p> <p>LLO 4.2 Prepare a drilling job as per given drawing.</p>	4	*Produce a job on a drilling machine comprising drilling and reaming operations as per the given drawing.	4	CO1
<p>LLO 5.1 Setup a drill machine and tool for given job as per operations.</p> <p>LLO 5.2 Prepare a tapping job as per given drawing.</p>	5	*Produce a job on drilling machine comprising tapping operation as per the given drawing.	4	CO1

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 6.1 Setup a drill machine and tool for given job as per operations. LLO 6.2 Prepare a counter-boring job as per given drawing.	6	Produce a job on a drilling machine comprising counter-boring operation as per the given drawing.	4	CO1
LLO 7.1 Setup a milling machine and cutter for given job. LLO 7.2 Prepare a job on milling machine as per the given drawing.	7	Produce a job on a milling machine that comprises of plain milling operation as per the given drawing.	4	CO2
LLO 8.1 Setup a milling machine and side milling cutter for given job. LLO 8.2 Prepare a job on milling machine as per the given drawing.	8	Produce a job on a milling machine that comprises of side milling operation as per given drawing.	4	CO2
LLO 9.1 Setup a milling machine and cutter for given job. LLO 9.2 Use dividing head for indexing. LLO 9.3 Prepare a spur gear on milling machine as per the given drawing.	9	*Produce a spline shaft with 3 slots using indexing mechanism as per the given drawing.	4	CO2
LLO 10.1 Select material and tool for preparing pattern. LLO 10.2 Prepare wooden pattern as per given drawing.	10	*Produce a simple wooden pattern for the given component.	4	CO3
LLO 11.1 Choose appropriate sand and tools for moulding a given pattern. LLO 11.2 Prepare a mould for given pattern.	11	*Produce a sand mould for the given pattern.	4	CO3
LLO 12.1 Select suitable material and melt it for required casting. LLO 12.2 Prepare casting as per given drawing.	12	*Produce a casting from the given mould.	4	CO3
LLO 13.1 Identify various components of forging machine. LLO 13.2 Enlist various forging operations. LLO 13.3 Identify need of safety while working in forging shop.	13	Demonstrate components of a forging machine and its safety considerations.	4	CO4
LLO 14.1 Select tool for producing given job. LLO 14.2 Prepare a bolt head/a cold chisel/hook as per given drawing.	14	*Produce a bolt head/cold chisel/hook using forging.	4	CO4
LLO 15.1 Identify various components of rolling mill/machine. LLO 15.2 Enlist rolling methods used in industries. LLO 15.3 Identify need of safety while working rolling shop.	15	Demonstrate the various parts of rolling mill/machine and various safety aspects of it.	4	CO4

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 16.1 Identify various components of Press tool. LLO 16.2 Identify type of die used for production of washer. LLO 16.3 Identify need of safety while working in press shop.	16	Demonstrate production process of washer.	2	CO4
LLO 17.1 Prepare material for fabricating structure. LLO 17.2 Select suitable equipment and tool for welding. LLO 17.3 Fabricate structure as per given drawing.	17	*Fabricate structure using arc welding machine as per given drawing.	4	CO5
LLO 18.1 Prepare joint for soldering/brazing by applying flux. LLO 18.2 Perform soldering/brazing operations on the given components.	18	*Perform soldering/brazing operations on the given components.	2	CO5
LLO 19.1 Enlist various welding defects and their causes. LLO 19.2 Identify casting defects in the given welded joints.	19	Identify various welding defects from given castings.	2	CO5
Note : Out of above suggestive LLOs - <ul style="list-style-type: none"> *' 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

- Justify why lathe machine is called mother of all machines.
- Collect information regarding car bonnet manufacturing in automobile industry.
- Collect information of material used for preparation of pattern.
- Justify necessity of safety precaution in industries.
- Prepare a list of machine tools seen in the industry during industrial visit.

Micro project

- Collect specifications of machine tools available in the industry you have visited.
- Prepare a list of similar operations that can be performed on different machine tools along with their specifications.
- Collect different welding equipments required for a welding shop.
- Collect a information about operations required for key manufacturing.
- Prepare a list of machine tools available in the workshop of the institute with their specifications.

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.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Centre lathe machine. (Length between canters 1000 mm, swing 500 mm)	1,2,3
2	Drilling Machine (drill diameter up to 40 mm)	4,5,6
3	Column and knee type milling machine along with dividing head (length X width of working table 1000 mm X 500)	7,8,9
4	Pattern making, moulding and casting shop with necessary equipment.	10,11,12
5	Mini forging press (Capacity upto 1 ton)	13,14
6	Rolling mill (Laboratory type)	15
7	Mini press tool (Capacity upto 1 ton)	16
8	TIG/MIG welding equipmet (upto 160 A, 240 Volts)	17,18,19

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	Fundamentals of Lathe and drilling machines	CO1	10	4	6	6	16
2	II	Milling Machines	CO2	9	4	6	6	16
3	III	Casting processes	CO3	9	2	6	4	12
4	IV	Forming processes	CO4	8	2	4	4	10
5	V	Metal joining processes	CO5	9	4	8	4	16
Grand Total				45	16	30	24	70

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Tests
- Seminar/Presentation
- Term Work

Summative Assessment (Assessment of Learning)

- Practical
- Theory

XI. SUGGESTED COS - POS MATRIX FORM

MANUFACTURING TECHNOLOGY

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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	2	2	-	2	2			
CO2	3	2	2	2	-	2	2			
CO3	3	2	2	2	-	2	2			
CO4	3	2	2	2	-	2	2			
CO5	3	2	2	2	-	2	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	P N RAO	Manufacturing Technology Vol-1	McGraw Hill, New Delhi. ISBN-1259062570, 9781259062575
2	P N RAO	Manufacturing Technology Vol-2	McGraw Hill, New Delhi, ISBN: 9789353160524
3	S K Hajra Choudhury, A K Hajra Choudhury, Nirjhar Roy	Elements Of Workshop Technology Vol-1	Media Propoters & Publisher PVT. LMT. ISBN-13 5551234102415
4	S K Hajra Choudhury, A K Hajra Choudhury, Nirjhar Roy	Elements Of Workshop Technology Vol-2	Media Propoters & Publisher PVT. LMT., ISBN: 978-8-185-09915-6.
5	D.P. Agrawal	Ancient Metal Technology and Archaeology of South Asia: a Pan-Asian perspective	Aditya Prakashan, New Delhi. ISBN: 9788173051777

XIII. LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=Wc2gpWcmGK4	Lathe Machine Operations
2	https://www.youtube.com/watch?v=DGsV6RhBnbM	Radial drilling machine
3	https://www.youtube.com/watch?v=zzXdddrV2so	Simple Job on milling machine
4	https://www.youtube.com/watch?v=2CIcvB72dmk	Basics of Metal Casting
5	https://www.youtube.com/watch?v=-w7E88zox6w	Closed die forging
6	https://www.youtube.com/watch?v=RyLvVMg84xs	Basics of welding process

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Semester - 2, K Scheme