FLUID MECHANICS AND MACHINERY **Course Code : 313309**

Programme Name/s : **Mechanical Engineering**
Programme Code : **ME**
Semester : **Third**
Course Title : **FLUID MECHANICS AND MACHINERY**
Course Code : **313309**

I. RATIONALE

The knowledge of fluid properties, fluid flow & fluid machinery is essential in many fields of engineering like in power generation, irrigation, water supply, etc. This course aims to develop the skills that will enable the students to select appropriate hydraulic devices and machines like pressure gauges, flow measuring devices, pipes, pumps, turbines, etc. for a particular application.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

This course will enable the students to Select appropriate hydraulic machine(s) based on its application for efficient functioning

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Determine different properties of fluid and pressure measurements
- CO2 - Apply Bernoulli's theorem to various flow measuring devices.
- CO3 - Calculate the various losses in flow through pipes
- CO4 - Select suitable hydraulic turbine and pump for the given application
- CO5 - Evaluate the performance of hydraulic turbines and pumps

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313309	FLUID MECHANICS AND MACHINERY	FMM	DSC	3	-	2	1	6	3	3	30	70	100	40	25	10	25#	10	25	10	175

FLUID MECHANICS AND MACHINERY **Course Code : 313309**

Total IKS Hrs for Sem. : 1 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

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

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain various properties of fluids TLO 1.2 Explain different types of fluids TLO 1.3 Compare given fluids based on the required physical properties TLO 1.4 Calculate pressure head using manometer. TLO 1.5 Calculate fluid pressure, total pressure and center of pressure on given immersed body for given position in specified liquid	**Unit - I Properties of Fluid and Fluid Pressure Measurement** 1.1 Properties of Fluid: Density, Specific gravity, Specific volume, Specific Weight, Dynamic viscosity, Kinematic viscosity, Surface tension, Capillarity, Vapor Pressure, Compressibility, Types of fluids, Simple numerical on properties of fluids 1.2 Fluid Pressure: Fluid pressure, Pressure head, Pressure intensity, Pascal’s law, Concept of absolute vacuum, gauge pressure, atmospheric pressure, absolute pressure, Different units of pressure and their inter-relation, Simple numerical 1.3 Fluid Pressure Measurement Devices: Construction and working principle of piezometer, simple U-tube manometer and differential U-tube manometers, Numerical on above manometers, Construction and working principle of Bourdon tube pressure gauge 1.4 Hydrostatics: Total pressure, center of pressure- regular surface forces on immersed bodies in liquid in horizontal and vertical position, Simple Numerical	Lecture Using Chalk-Board Presentations Video Demonstrations Model Demonstration

FLUID MECHANICS AND MACHINERY **Course Code : 313309**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Classify different types of fluid flows TLO 2.2 Apply Continuity equation and Bernoulli's equation to the various flow measuring devices TLO 2.3 Describe procedure to calculate discharge using the given flow measuring device TLO 2.4 Calculate the flow rate using given flow measuring device	**Unit - II Fundamentals of Fluid Flow and Flow Measurement** 2.1 Types of Fluid Flows: steady, unsteady, uniform, non uniform, rotational, irrotational, 1-D, 2-D and 3-D flows, Laminar, turbulent, Concept of Reynold's number 2.2 Continuity equation, Bernoulli's theorem 2.3 Construction and working principle of Venturimeter, coefficient of discharge, simple numerical on it 2.4 Construction and working principle of Orifice meter, Hydraulic coefficients (Cd, Cc, Cv), simple numerical on it 2.5 Construction and working principle of Pitot Tube and numerical on it	Lecture Using Chalk-Board Presentations Video Demonstrations Model Demonstration Hands-on
3	TLO 3.1 State laws of fluid friction for laminar and turbulent flow TLO 3.2 Calculate frictional losses using Darcy's equation and Chezy's equation TLO 3.3 Describe various minor losses in fluid flow TLO 3.4 Interpret hydraulic gradient line and total energy line TLO 3.5 Calculate hydraulic power transmission, hydraulic efficiency through pipes TLO 3.6 Describe water hammer phenomenon with remedial measures	**Unit - III Flow through Pipes** 3.1 Laws of fluid friction for laminar and turbulent flow 3.2 Darcy's equation and Chezy's equation for calculation of frictional losses, Numerical on above equations 3.3 Minor losses in fittings and valves (No numerical) 3.4 Hydraulic gradient line and total energy line 3.5 Hydraulic power transmission through pipes, Simple numerical 3.6 Water hammer phenomenon in pipes, causes and remedial measures	Lecture Using Chalk-Board Presentations Video Demonstrations Hands-on Role Play

FLUID MECHANICS AND MACHINERY **Course Code : 313309**

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 Calculate the force exerted by a jet, work done and efficiency for the given vane condition TLO 4.2 Explain the working of hydroelectric power plant TLO 4.3 Explain the construction and working of given hydraulic turbine along with velocity diagrams TLO 4.4 Select the suitable hydraulic turbine for given application with justification TLO 4.5 Evaluate the performance of given hydraulic turbine	**Unit - IV Hydraulic Turbines** 4.1 Impact of jet on fixed vertical flat plate, moving vertical flat plate, curved vanes with special reference to turbines and pumps, Numerical on above conditions 4.2 Layout of hydroelectric power plant and function of each component, Water Storage systems used in Ancient India (IKS) 4.3 Classification of hydraulic turbines 4.4 Construction, working principle, velocity diagram and applications of Pelton wheel, Kaplan turbine and Francis turbine 4.5 Draft tubes: Types, Concept of cavitation in turbines 4.6 Calculation of Work done, Power output, efficiency of Pelton turbine only 4.7 Criteria for selection of hydraulic turbines and performance characteristics	Lecture Using Chalk-Board Presentations Video Demonstrations Model Demonstration Case Study Hands-on
5	TLO 5.1 Describe the construction and working of different types of hydraulic pumps TLO 5.2 Select the suitable hydraulic pump for given application with justification TLO 5.3 Evaluate the performance of given hydraulic pump TLO 5.4 Apply the troubleshooting procedure to rectify identified fault in centrifugal pump TLO 5.5 Distinguish between centrifugal and reciprocating pump	**Unit - V Centrifugal and Reciprocating Pumps** 5.1 Centrifugal Pumps: Water lifting devices used in Ancient India (IKS), Classification, Construction and working principle of Centrifugal pump, Types of casings and impellers, Priming methods, Static head, Manometric head, NPSH, Work done, Manometric efficiency, Overall efficiency, Numerical on above parameters, Performance Characteristics of Centrifugal pumps, Troubleshooting, Construction, working and applications of multistage pump 5.2 Reciprocating Pump: Construction, working principle and applications of single and double acting reciprocating pumps, Slip, Negative slip, Cavitation and Separation, Use of air vessels, Indicator diagram with effect of acceleration head & frictional head, Pump selection criteria based on head and discharge (No numerical on reciprocating pumps)	Lecture Using Chalk-Board Presentations Video Demonstrations Model Demonstration Case Study Hands-on

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 Bourdon tube pressure gauge for pressure measurement LLO 1.2 Use U-tube Manometer for pressure measurement	1	*Measurement of water pressure by using Bourdon tube pressure gauge and U-tube Manometer	2	CO1
LLO 2.1 Calculate discharge of water using a measuring tank and stopwatch	2	Measurement of discharge of water by using a measuring tank and stopwatch	2	CO2

FLUID MECHANICS AND MACHINERY **Course Code : 313309**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 3.1 Calculate total energy available at different sections of a pipe layout LLO 3.2 Verify Bernoulli's theorem	3	Measurement of total energy available at different sections of a pipe layout to verify Bernoulli's theorem	2	CO2
LLO 4.1 Apply Bernoulli's theorem to Venturimeter LLO 4.2 Measure discharge through pipe using Venturimeter	4	*Measurement of discharge through pipe using Venturimeter	2	CO2
LLO 5.1 Measure discharge using sharp edged circular orifice	5	Measurement of discharge through a pipe provided with sharp edged circular orifice	2	CO2
LLO 6.1 Apply Bernoulli's theorem to Orifice meter LLO 6.2 Measure discharge through pipe using orifice meter	6	Measurement of discharge through pipes using orifice meter	2	CO2
LLO 7.1 Calculate Reynolds number at given flow rate of water LLO 7.2 Interpret the type of flow based on calculated Reynolds number	7	Interpretation of the type of flow using Reynolds apparatus	2	CO2
LLO 8.1 Calculate Darcy's friction factor 'f' in pipe of different diameters LLO 8.2 Interpret effect of material and diameter of pipe, flow rate of water on Darcy's friction factor 'f'	8	*Calculation of Darcy's friction factor 'f' in pipes of different diameters for different discharges	2	CO3
LLO 9.1 Calculate minor frictional losses due to sudden expansion in a pipe LLO 9.2 Calculate minor frictional losses due to sudden contraction in a pipe	9	*Determination of minor frictional losses in sudden expansion and sudden contraction in a pipe	2	CO3
LLO 10.1 Calculate minor frictional losses due to bend provided in a pipe LLO 10.2 Calculate minor frictional losses due to elbow provided in a pipe	10	Determination of minor frictional losses in elbow and bend in a pipe	2	CO3
LLO 11.1 Calculate the force exerted by a jet on flat plate LLO 11.2 Calculate the work done by a jet on flat plate	11	Determination of the force exerted and work done by a jet on flat plate	2	CO5
LLO 12.1 Measure the power output of Pelton wheel at different flow rates LLO 12.2 Calculate overall efficiency of Pelton wheel LLO 12.3 Plot performance characteristics of Pelton wheel based on results	12	*Determination of overall efficiency of Pelton turbine using Pelton wheel test rig	2	CO5

FLUID MECHANICS AND MACHINERY **Course Code : 313309**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 13.1 Identify various components of centrifugal pump LLO 13.2 Assess the condition of various components of centrifugal pump LLO 13.3 Suggest remedial action to be taken	13	*Dismantling and Assembly of a Centrifugal pump	2	CO4
LLO 14.1 Measure the manometric head (Hm) at different flow rates LLO 14.2 Calculate overall efficiency of centrifugal pump LLO 14.3 Plot performance characteristics based on the results	14	*Determination of overall efficiency of Centrifugal pump using Centrifugal pump test rig	2	CO5
LLO 15.1 Identify various components of available reciprocating pump LLO 15.2 Assess the condition of various components of reciprocating pump LLO 15.3 Suggest remedial action to be taken	15	Dismantling and Assembly of a Reciprocating pump	2	CO4
LLO 16.1 Calculate overall efficiency of reciprocating pump LLO 16.2 Calculate percentage slip of reciprocating pump	16	*Determination of overall efficiency and percentage slip of Reciprocating pump using Reciprocating pump test rig	2	CO5

Note : Out of above suggestive LLOs -

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

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

Assignment

- Prepare a chart showing the various units of pressure and interrelation among them.

Micro project

- Prepare a detailed report based on locations and specifications of Pelton wheel/ Kaplan/ Francis/ any other turbine used in India or Abroad from the internet.
- Prepare a detailed report based on the range of products, manufacturer and technical specifications of Centrifugal/ reciprocating/ multistage pumps/ submersible pumps/any other pump from the local market or internet.
- Visit a hydroelectric power plant and prepare a report on layout of plant, components of plant and specifications of turbines used in the plant.

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.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Centrifugal pump test rig along with necessary pipe fittings and accessories comprising of: Centrifugal pump with motor: Variable speed, 2800 RPM Supply tank: 80 Ltrs. made of Mild steel with FRP lining Bourdon tube pressure gauge: Range-0-12 bar Venturimeter: 13 mm (Mild steel) U-tube manometer: Wall/ Stand mounted thick walled Borosilicate glass tube Measuring tank: 40 Ltrs. made of Mild steel with FRP lining and fitted with piezometer tube and scale Stop watch: Electronic with least count of 0.01 sec Measuring scale: Range up to 60 cm Any other measuring device like rotameter/ flow meter of suitable specifications	1,2
2	Impact of jet test rig with necessary pipe fittings and accessories comprising of: Plexiglass cylindrical tank, 5 mm diameter nozzle, 8 mm diameter nozzle, impact object of flat shape having 30 mm diameter, Nozzle distance-impact object- 20 mm, Set of stainless steel weights Measuring tank: 40 Ltrs. made of Mild steel with FRP lining and fitted with piezometer tube and scale Stop watch: Electronic with least count of 0.01 sec Measuring scale: Range up to 60 cm	11
3	Pelton wheel test rig with necessary pipe fittings and accessories comprising of: Pelton wheel: Speed- 750-900 rpm, Output power- 3.7 kW (5 HP), Head- 45-50 m, Discharge- 700-900 LPM Centrifugal pump, Venturimeter, U-tube differential manometer, Water storage and supply arrangement as per requirement	12
4	Working model of centrifugal pump having technical Specifications: Power: 1HP (0.75 kW) Max. head: Up to 34 meters Max. discharge: Up to 2700 LPH OR Any other suitable centrifugal pump which can be dismantled and assembled using spanner set and tool kit	13

FLUID MECHANICS AND MACHINERY **Course Code : 313309**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
5	Centrifugal pump test rig with necessary pipe fittings and accessories comprising of: Centrifugal pump with motor: Variable speed, 2800 RPM Vacuum gauge Bourdon type: Range- 0-760 mm of Hg Pressure gauge Bourdon type: Range- 0-4 kg/cm2 Compound gauge Bourdon type: 760 mm of Hg to 2 kg/cm2 Supply tank: 80 Ltrs. made of Mild steel with FRP lining Measuring tank: 40 Ltrs. made of Mild steel with FRP lining and fitted with piezometer tube and scale Stop watch: Electronic with least count of 0.01 sec Measuring scale: Range up to 60 cm	14
6	Working model of reciprocating pump having technical Specifications: Reciprocating Pump: 1.02HP/0.8KW, 2900 RPM, Single phase OR Any other suitable centrifugal pump which can be dismantled and assembled using spanner set and tool kit	15
7	Reciprocating pump test rig with necessary pipe fittings and accessories comprising of: Reciprocating Pump: 1 HP, 700 RPM Motor: 1 HP, 1500 RPM Supply tank: 80 Ltrs. made of Mild steel with FRP lining Measuring tank: 40 Ltrs. made of Mild steel with FRP lining and fitted with piezometer tube and scale Tachometer: 10-10,000 RPM, Accuracy- 0.5% Full scale Energy meter for motor input measurement Pressure & Vacuum gauge for measurement of head Dimmer to vary the speed Stop watch: Electronic with least count of 0.01 sec Measuring scale: Range up to 60 cm	16
8	Bernoulli’s theorem Test rig along with necessary pipe fittings and accessories comprising of: Pump with Motor: Mono-block pump- Single phase, 0.5 HP Differential Venturi of 300 mm length made out of Acrylic square bar Supply tank: 80 Ltrs. made of Mild steel with FRP lining Piezometer tubes: Range- 0 to 12 bar Measuring tank: 40 Ltrs. made of Mild steel with FRP lining and fitted with piezometer tube and scale Stop watch: Electronic with least count of 0.01 sec Measuring scale: Range up to 60 cm	3
9	Venturimeter and orifice meterTest Rig along with necessary pipe fittings and accessories comprising of: Centrifugal pump with motor: Variable speed, 2800 RPM Supply tank: 80 Ltrs. made of Mild steel with FRP lining Venturimeter: 13 mm (Mild steel) , Orifice meter of suitable specifications) U-tube manometer: Connected to pipe and throat of Venturimeter , connected to pipe and vena contracta of orifice meter Measuring tank: 40 Ltrs. made of Mild steel with FRP lining and fitted with piezometer tube and scale Stop watch: Electronic with least count of 0.01 sec Measuring scale: Range up to 60 cm	4,6

FLUID MECHANICS AND MACHINERY **Course Code : 313309**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
10	Sharp edged circular orifice test rig along with necessary pipe fittings and accessories comprising of: Centrifugal pump with motor of suitable specifications Supply tank: 80 Ltrs. made of Mild steel with FRP lining Sharp edged circular orifice of suitable specifications U-tube manometer: Connected to pipe and Orifice meter Measuring tank: 40 Ltrs. made of Mild steel with FRP lining and fitted with piezometer tube and scale Stop watch: Electronic with least count of 0.01 sec Measuring scale: Range up to 60 cm	5
11	Reynolds apparatus Test rig with necessary pipe fittings and accessories comprising of: Tube: Clear acrylic 800 mm Length, 32mm Outer Dia. and 25mm Inner Dia. Dye Vessel: Material Stainless Steel, 1 liter capacity Constant Head Tank: 300mm x 300mm x 450mm Measuring Tank: 300mm x 300mm x 300mm Supply Tank: 600mm x 300mm x 300mm Valves (Gunn Metal): 2 Nos. for Drain, 1 No. for Water Control, 1 No. for Bye pass Stop watch: Electronic with least count of 0.01 sec Pump: Single phase, 0.5 HP	7
12	Flow through pipe Test rig with necessary pipe fittings and accessories comprising of: Pipes: 03 nos. Made of GI ½'', 1'', 1.5'' diameter or equivalent diameters and length 1m, 1.5m, 2m or equivalent length Large bend: Made of GI Sudden enlargement fitting of suitable size Sudden contraction fitting of suitable size Pump: 1HP Centrifugal pump Supply tank: 80 Ltrs. made of Mild steel with FRP lining U-tube manometer: Connected to pipe at required locations using plastic tubing Measuring tank: 40 Ltrs. made of Mild steel with FRP lining and fitted with piezometer tube and scale Gate valves to regulate the flow of water Stop watch: Electronic with least count of 0.01 sec Measuring scale: Range up to 60 cm	8,9,10

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	Properties of Fluid and Fluid Pressure Measurement	CO1	8	2	4	6	12
2	II	Fundamentals of Fluid Flow and Flow Measurement	CO2	6	2	4	4	10
3	III	Flow through Pipes	CO3	6	2	4	4	10
4	IV	Hydraulic Turbines	CO4,CO5	14	2	8	12	22
5	V	Centrifugal and Reciprocating Pumps	CO4,CO5	11	4	4	8	16
Grand Total				**45**	**12**	**24**	**34**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

FLUID MECHANICS AND MACHINERY **Course Code : 313309**

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators. Each practical will be assessed considering

1) 60% weightage is to process
2) 40% weightage to product

Summative Assessment (Assessment of 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

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1	1	1	-	-	1			
CO2	3	1	1	1	-	-	1			
CO3	3	2	1	1	-	-	1			
CO4	3	2	2	-	1	-	2			
CO5	3	3	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	Er. R.K. Rajput	A Textbook of Fluid Mechanics and Hydraulic Machines	S. Chand and Company Pvt. Ltd., New Delhi ISBN: 9789385401374
2	Dr. R.K. Bansal	Fluid Mechanics and Hydraulic Machines	Laxmi Publications Pvt. Ltd., New Delhi ISBN: 9788131808153
3	Dr. P.N. Modi, Dr. S.M. Seth	Hydraulics and Fluid Mechanics including Hydraulic Machines	Standard Book House, New Delhi ISBN: 13: 9788189401269
4	S. Ramamrutham	Hydraulic, Fluid Mechanics and Fluid Machines	Dhanpat Rai Publishing Company (P) Ltd. ISBN: 9789384378271

FLUID MECHANICS AND MACHINERY **Course Code : 313309**

Sr.No	Author	Title	Publisher with ISBN Number
5	Victor Streeter, K.W. Bedford, E. Benjamin Wylie	Fluid Mechanics	McGraw-Hill Education ISBN: 9780070701403
6	K. Subramanya	Fluid Mechanics and hydraulic Machines: Problems and Solutions	Tata McGraw-Hill Co. Ltd., New Delhi ISBN: 9789353163426
7	R.S. Khurmi, N. Khurmi	A Textbook of Hydraulics, Fluid Mechanics and Hydraulic Machines	S. Chand and Company Pvt. Ltd., New Delhi ISBN: 9788121901628
8	Som S.K., Biswas G.	Introduction to Fluid Mechanics and Fluid Machines	Tata McGraw-Hill Co. Ltd., New Delhi ISBN: 9780071329194
9	Dr. Jagdish Lal	Fluid Mechanics and Hydraulic Machines	Metropoliton ISBN: 9788120004221
10	C.S.P. Ojha, P.N. Chandramouli, and R. Berndtsson	Fluid Mechanics and Machinery	Oxford University Press, New Delhi ISBN: 9780195699630
11	Raikar R.V.	Laboratory Manual Hydraulics and Hydraulic Machines	PHI Learning Pvt. Ltd., New Delhi ISBN: 9788120346642

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	http://www.aboutmech.com/2016/08/total-pressure-and-centre-of-pressure.html	Total Pressure and Centre of Pressure
2	https://www.youtube.com/watch?v=UJ3-Zm1wbIQ	Bernoulli's Principle
3	https://www.youtube.com/watch?v=_bfcdRhY7Rw	Working Principle of Venturimeter
4	https://www.youtube.com/watch?v=iRdJHPFVHwM	Orifice Meter Working Principle
5	https://www.youtube.com/watch?v=3zEdtkuNYLU	Pitot Tube Working Animation
6	https://www.youtube.com/watch?v=Rwl1mu0TJmE	Types of Notches
7	https://www.youtube.com/watch?v=FHTVmKdS_Lk&list=PLdoIhVhbPQV5z6g7aT_LpC8mJb31hNiBx&index=2	Impact of Jet on Fixed Vertical Plate
8	https://www.youtube.com/watch?v=tOoBx4-ieyU&list=PLdoIhVhbPQV5z6g7aT_LpC8mJb31hNiBx&index=3	Impact of Jet on Moving Vertical Flat Plate
9	https://www.youtube.com/watch?v=cpM6hF23eeQ&list=PLdoIhVhbPQV5z6g7aT_LpC8mJb31hNiBx&index=11	Impact Of Liquid Jet on Series of Flat Plate Mounted on a Wheel
10	https://www.youtube.com/watch?v=Jd5BN7SPkqI	Pelton Wheel
11	https://www.youtube.com/watch?v=0p03UTgpnDU	Kaplan Turbine Working and Design
12	https://www.youtube.com/watch?v=3BCiFeykRzo	Working of Francis Turbine
13	https://www.youtube.com/watch?v=IiE8skW8btE	Centrifugal Pump
14	https://www.youtube.com/watch?v=41vb6T42_Tk	Reciprocating Pump animation
15	https://www.youtube.com/watch?v=xqGyPdxLlRg	Jet Pump Working Animation
16	https://www.energy.gov/eere/water/types-hydropower-turbines	Types of Hydropower Turbines

FLUID MECHANICS AND MACHINERY **Course Code : 313309**

Sr.No	Link / Portal	Description
17	https://www.realpars.com/blog/manometer#:~:text=Measuring%20pressure,-The%20tube%20is&text=When%20the%20pressures%20are%20equal,side%20because%20P1%20equals%20P2	Manometer working principle
18	https://tameson.com/pages/bourdon-tube-pressure-gauge	Bourdon Tube Pressure Gauge
19	http://ecoursesonline.iasri.res.in/mod/page/view.php?id=1086	Major and Minor Hydraulic Losses Through Pipes And Fitting
20	http://ecoursesonline.iasri.res.in/course/view.php?id=27	Fluid Mechanics Course
21	https://theconstructor.org/fluid-mechanics/types-fluid-flow-pipe/38078/	Types of Fluid Flows
22	https://www.chaitanyaproducts.com/blog/ancient-indian-water-conservation-techniques-part-1/	Water Storage Systems used in Ancient India (IKS)
23	https://www.youtube.com/watch?v=hQr5Op4S5q4&t=83s	Water Lifting Devices (Araghatta) used in Ancient India (IKS)
24	https://www.youtube.com/watch?v=uTrajIJ79ME&t=49s	Water Lifting Devices (Chadas) used in Ancient India (IKS)

Note :

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

MSBTE Approval Dt. 02/07/2024 **Semester - 3, K Scheme**

BASIC ELECTRICAL AND ELECTRONICS **Course Code : 312020**

Programme Name/s	**: Automobile Engineering./ Agricultural Engineering/ Chemical Engineering/ Mechanical Engineering/ Production Engineering/ Polymer Technology**
Programme Code	**: AE/ AL/ CH/ ME/ PG/ PO**
Semester	**: Second / Third / Fourth**
Course Title	**: BASIC ELECTRICAL AND ELECTRONICS**
Course Code	**: 312020**

I. RATIONALE

Modern engineering systems, irrespective of the field, are increasingly incorporating smart technologies that rely on electrical and electronics components. Many engineering projects involve the integration of mechanical, electrical and electronic components. A well-rounded education in electrical and electronics principles enables engineers to work seamlessly across disciplines. In Chemical Engineering, Agricultural Engineering and Polymer Technology, precise measurement and control of variables are crucial. The fourth industrial revolution emphasizes the integration of digital technologies into manufacturing and engineering processes. Electrical and electronics knowledge is fundamental for implementing Industry 4.0 concepts in Engineering fields .This course will develop skills in handling tools and equipment related electrical and electronics engineering and provide the necessary foundation for understanding, maintaining and implementing advanced systems.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcomes through various teaching learning experiences: Use Electrical and Electronics equipment safely in mechanical engineering applications

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Use Principles of electrical and magnetic circuits to solve mechanical engineering broadly defined problems.
- CO2 - Use of Transformer and Electric motors for given applications.
- CO3 - Suggest suitable electronic component for given mechanical engineering application.
- CO4 - Use of diodes and transistors as a relevant component in given electric circuits of . mechanical engineering application

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312020	BASIC ELECTRICAL AND ELECTRONICS	BEE	AEC	2	-	4	-	6	3	-	-	-	-	-	50	20	50@	20	-	-	100

BASIC ELECTRICAL AND ELECTRONICS **Course Code : 312020**

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	TLO 1.1 Explain the given technical terms related to Electric and Magnetic circuits . TLO 1.2 Identify analogy between Electric and Magnetic Circuits. TLO 1.3 Apply Fleming's right hand rule and Lenz's law for determination of direction of induced emf in the given situation. TLO 1.4 Explain attributes of the given AC quantities. TLO 1.5 Find currents and voltages in the given series and parallel AC circuits.	**Unit - I Electric and Magnetic Circuit** 1.1 1 Electric circuits E.M.F, Potential difference, power, Magnetic circuits M.M.F, magnetic force, permeability. 1.2 Electromagnetic induction, Faraday's laws of electromagnetic induction, Lenz's law, dynamically induced emf. 1.3 Statically induced emf. (a) Self induced emf (b) Mutually induced emf; Equations of self and mutual inductance. 1.4 A .C. Signal terms: Cycle, Frequency, Periodic time, Amplitude, Angular velocity, RMS value, Average value, Form Factor, Peak Factor, impedance, phase angle, and power factor. 1.5 Voltage and Current relationship in Star and Delta connections. Working of Batteries, wiring specifications and IS electrical standards for safety and appliances.	Chalk-Board Presentations Videos on Flemings Right hand rule and Lenz Law

BASIC ELECTRICAL AND ELECTRONICS **Course Code : 312020**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Explain with sketches the construction and working principle of the given type of single phase transformer. TLO 2.2 Explain with sketches the working principle of the given autotransformer. TLO 2.3 Describe with sketches the construction of the given single phase motor. TLO 2.4 Explain with the sketches the working principle of the given single phase induction motors.	**Unit - II Transformer and single phase induction motor** 2.1 General construction and principle of different type of transformers, EMF equation and transformation ratio of transformers. 2.2 Auto transformers. Working Principle and applications 2.3 Construction and Working principle of single phase AC. motor. Types of single phase motors, applications of single phase motors. 2.4 Applications of Induction motors	Chalk-Board Demonstration Hands-on
3	TLO 3.1 Differentiate between the given active and passive components. TLO 3.2 Determine the value of given resistor and capacitor using color code and printed information on components . TLO 3.3 Explain the given signal parameters with sketches. TLO 3.4 Identify the given type of ICs based on the IC number	**Unit - III Electronic Components and Signals** 3.1 Electronic Components : Passive and Active components: Resistor, Capacitor, Inductor, symbols color codes, specifications. 3.2 Voltage and current sources, signals: Waveform (Sinusoidal, triangular and square). 3.3 Time and frequency domain representation of signals.Amplitude, frequency, phase, wavelength. 3.4 Integrated circuits - Analog and Digital.	Chalk-Board Demonstration of components Hands-on
4	TLO 4.1 Explain with the sketches the working of given type of diode using its V-I characteristics. TLO 4.2 .Explain with the sketches the working of given type of rectifier using circuit diagram. TLO 4.3 Justify the given selection of power supply and LEDs for the given circuit. TLO 4.4 Explain with the sketches the application of the given type of transistor as a switch. TLO 4.5 Compare the performances of the given transistor configurations.	**Unit - IV Diodes and Bipolar Junction Transistor** 4.1 Diodes and its Applications: P-N junction diode: symbol, construction working and applications ,Zener diode: working, symbol, voltage regulator. 4.2 Rectifiers: Half wave, Full wave, Bridge rectifier Performance parameters: PIV, ripple factor, efficiency. 4.3 Light Emitting Diodes: symbol, construction, working principle and applications. 4.4 BJT Symbol, construction, working principle Transistor as switch and amplifier. 4.5 Input and Output characteristics: CE configurations, Operating regions: Cut-off, saturation Active Region.	Chalk-Board Demonstration Hands-on

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 Measure voltage and current in single phase circuits with resistive load using appriopriate meters	1	* Voltage and Current measurement	2	CO1

BASIC ELECTRICAL AND ELECTRONICS **Course Code : 312020**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 2.1 Measure power required by single phase circuit with resistive load.	2	* Power measurement of single phase circuit	2	CO1
LLO 3.1 Measure Energy consumed by given equipment using energy meter.	3	Energy measurement	2	CO1
LLO 4.1 Measure average value, peak value and RMS value of AC waveform using CRO./ DSO LLO 4.2 Measure time and frequency of AC waveform using CRO./ DSO	4	AC signal parameters	2	CO1
LLO 5.1 Make a star and delta connection to measure line and phase voltage	5	* Line and Phase voltage measurement of star - delta connection circuit	2	CO1
LLO 6.1 Test given battery using digital multimeter.	6	* Battery Testing	2	CO1
LLO 7.1 Connect Single phase transformer for measuring input and output quantities LLO 7.2 Determine its turns ratio	7	* Input and output quantities of Single phase transformer	2	CO2
LLO 8.1 Test primary and secondary winding to measure continuity of transformer.	8	Continuity test of transformer-primary and secondary windings	2	CO2
LLO 9.1 Measure output voltage of auto transformer	9	Auto transformer	2	CO2
LLO 10.1 Identify parts of single phase induction motor.	10	* Single phase induction motor	2	CO2
LLO 11.1 Select the suitable gauge of wire for given electrical application.	11	* Electrical wire specifications	2	CO2
LLO 12.1 Build the switch board for given requirement by connecting suitable coloured wire to respective terminals .	12	* Electrical Swichboard assembly	2	CO2
LLO 13.1 Identify Passive electronic components on given electronics circuit	13	* Passive electronic components	2	CO3
LLO 14.1 Connect the capacitors in series combination on bread board to measure its value using multimeter. LLO 14.2 Connect the capacitors in parallel combination on bread board to measure its value using multimeter.	14	* Resistors in series and parallel connections	2	CO3
LLO 15.1 Connect the capacitors in series combination on bread board to measure its value using multimeter. LLO 15.2 Connect the capacitors in parallel combination on bread board to measure its value using multimeter.	15	Capacitors in series and Parallel connections	2	CO3
LLO 16.1 Use LCR-Q meter for measuring the value of given Inductor and Capacitors.	16	* LCR-Q meter	2	CO3
LLO 17.1 Identify various active electronic components in given circuit.	17	* Active electronic components	2	CO3
LLO 18.1 Test the given P N junction diode using multi meter	18	* P N Junction diode	2	CO4
LLO 19.1 Multi colour LEDs.	19	Multi colour LEDs	2	CO4

BASIC ELECTRICAL AND ELECTRONICS **Course Code : 312020**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 20.1 Identify type of seven segment display (Common anode / Common cathode)) LLO 20.2 Testing of seven- segment display.	20	* Seven- segment display	2	CO4
LLO 21.1 Built/ Test Half Wave Rectifier.	21	Half Wave Rectifier	2	CO4
LLO 22.1 Test Full Wave Rectifier using virtual Lab.	22	Full Wave Rectifier	2	CO4
LLO 23.1 Build/Test Bridge Rectifier constructed using four diodes LLO 23.2 Test bridge rectifier package	23	Bridge Rectifier	2	CO4
LLO 24.1 Identify three terminals of transistors using multimeter.	24	Three terminals of transistors	2	CO4
LLO 25.1 Test the performance of NPN transistor.	25	Testing of NPN transistor	2	CO4
LLO 26.1 Soldering and de- soldering given passive active components on PCB	26	* Soldering and De soldering	2	CO4
LLO 27.1 Test the performance of zener diode	27	Zener diode	2	CO4
LLO 28.1 Identify components of flasher circuits	28	Electronic flasher circuit	2	CO4
LLO 29.1 Identify terminals of three terminal positive and negative voltage regulator	29	* Three terminal voltage regulators	2	CO4
LLO 30.1 Build and test + 5 V regulated D C power supply using three terminal voltage regulator .	30	Regulated Power Supply	2	CO4

Note : Out of above suggestive LLOs -

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

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING) : NOT APPLICABLE

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Single Phase Autotransformer: Single phase, Input 0-230,10 A, Output:0-270 Volts	1,2
2	Clamp on Meter: 750 V, 2000 Counts	1,2
3	Single Phase Induction Motor - 230 V 50 Hz AC supply	11
4	LCR Q Meter: Parameter L-Q, C-D, R-Q and Z-Q Frequency 00 Hz, 120 Hz and 1 KHz Accuracy Basic Accuracy : 0.3% Display 5 digits display for both primary and secondary parameters L 100 Hz, 120 Hz 1 mH - 9999 H 1 KHz 0.1 mH - 999.9 H Measurement C 100 Hz, 120Hz 1 pF – 9999 mF Range 1 KHz 0.1 pF - 999.9 mF R, |Z| 0.0001V- 999.9 MV D, Q 0.0001 – 9999 D% 0.0001% - 9999% Test Level 120 Hz 0.3 Vrms (1 ±15%) (Range Auto 1 KHz and Open 100 Hz 0.42 Vrms (1±15%) Circuit) Ranging Mod Auto and Hold Equ	15

BASIC ELECTRICAL AND ELECTRONICS **Course Code : 312020**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
5	Function Generator: Frequency range 0.1Hz to 30 MHz sine, square, triangular, ramp and pulse generator, Output amplitude 20V open circuited, Output impedance 50 ohms. Facility to indicate output frequency and amplitude on display	22,23,24,29
6	Simulation software: Multisim, Proteus	23
7	CRO: Dual Channel, 4 Trace CRT / TFT based Bandwidth 20 MHz/30 MHz X10 magnification 20 nS max sweep rate, Alternate triggering Component tester and with optional features such as Digital Readout , USB interface or CRO with higher specifications	26,27,28,30
8	Digital Storage Oscilloscope: 25MHz/60MHz/70MHz/100MHz Dual Channel, 4 Trace TFT based X10 magnification 20 nS max sweep rate, Alternate triggering Component tester and with optional features such as Digital Read out, USB interface. Any other Oscilloscope with additional features is also suitable with magnifying probe at least two probes, if possible isolated probe	27,28,30
9	Single Phase Direct Measuring Energy Meter :100A 176 to 276V AC	3
10	Measurement Digital Multimeter: Minimum 3 ½ digit 4 ½ digit display, multimeter measures Vac, Vdc (1000V max), Adc, Aac (10-amp max), Resistance (0-100 Mohm), diode and transistor testing mode	4,6,12,14,17,18,19,20,21,25,13,9
11	Lamp Bank - 230 V 0-20 A	5
12	Single phase auto transformer-Single Phase Input 0-230,10A,output: 0-270Volts	7,8

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	Electric and Magnetic Circuit	CO1	7	0	0	0	0
2	II	Transformer and single phase induction motor	CO2	8	0	0	0	0
3	III	Electronic Components and Signals	CO3	7	0	0	0	0
4	IV	Diodes and Bipolar Junction Transistor	CO4	8	0	0	0	0
Grand Total				**30**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- For FA PR ,Formative (Continuous) assessment shall be based on process and product related performance indicators. Course teacher may assign 60%, weightage for process and 40% weightage for product related LL work .

Summative Assessment (Assessment of Learning)

- For SA PR At the end of semester PR examination will be conducted by course teacher and based on PR exam performance marks out of 50 will be allocated

XI. SUGGESTED COS - POS MATRIX FORM

BASIC ELECTRICAL AND ELECTRONICS **Course Code : 312020**

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			
CO2	2	-	-	2	-	-	1			
CO3	1	-	-	1	-	-	1			
CO4	1	1	1	1	-	-	1			

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Mittle and Mittal	Basic Electrical Engineering	McGraw Education, New Delhi, edition 2017, ISBN-13 978-0070593572
2	Jegathesan, V	Basic Electrical and Electronics Engineering	Wiley India, New Delhi, edition-2015 ISBN 978-8126529513
3	Sedha, R.S.	A Text book of Applied Electronics	S.Chand New Delhi, edition-2008 ISBN-13: 978-8121927833
4	Mehta, V.K. Mehta, Rohit	Principles of Electronics	S. Chand and Company, New Delhi, edition-2014, ISBN-13-9788121924504
5	Bell Devid	Fundamental of Electronic Devices and Circuits	Oxford University Press, New Delhi edition-2015 ISBN 978-0195425239
6	Susan S Mathew Saji T Chacko	Fundamental of Electrical and Electronics Engineering	Khanna Book Publishing Co (P) Ltd. New Delhi 978-93-91505-59-2

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://fossee.in/ (Open Source Electronics Simulation software) https://cloud.scilab.in/ (Open Source Scilab Cloud for Electronics Simulation)	Smulation
2	https://www.electrical4u.com/fleming-left-hand-rule-and-fleming-right-hand-rule/	Flemings Right hand and left hand rule
3	https://www.electrical4u.com/lenz-law-of-electromagnetic-induction/	Lenz's Law
4	https://www.animations.physics.unsw.edu.au/jw/	Electronic components, A.C. circuits, transformer, Electric motors.
5	https://en.wikipedia.org/wiki/Transformer	Transformer
6	http://www.alpharubicon.com/altenergy/understandingAC.htm	A.C. Current
7	https://www.learningaboutelectronics.com/Articles/	Electronic components
8	https://learn.sparkfun.com/tutorials/transistors	Transistors

BASIC ELECTRICAL AND ELECTRONICS **Course Code : 312020**

Sr.No	Link / Portal	Description
9	https://www.technologystudent.com/elec1/transis1.htm	Transistors
10	https://www.services.bis.gov.in/php/BIS_2.0/bisconnect/get_is_list_by_category_id/5	IS standards for electrical safety and appliances

Note :

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

MSBTE Approval Dt. 29/11/2023 **Semester - 2 / 3 / 4, K Scheme**

PRODUCTION DRAWING **Course Code : 313311**

Programme Name/s : **Mechanical Engineering/ Mechatronics/ Production Engineering**
Programme Code : **ME/ MK/ PG**
Semester : **Third**
Course Title : **PRODUCTION DRAWING**
Course Code : **313311**

I. RATIONALE

Production drawing is essential for communicating ideas in manufacturing industry as well as other engineering applications. Production drawings illustrate set of instructions to manufacture a product, providing information about dimensions, materials, finishes, tools required, methods of assembly and so on. Therefore, this course has been developed for interpretation and preparation of the production drawing.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Prepare Production drawing of a given part / component as per requirement.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Construct an auxiliary view of given object.
- CO2 - Use convention for representation of material and mechanical components.
- CO3 - Interpret and draw production drawing.
- CO4 - Prepare assembly drawing using given details.
- CO5 - Prepare detail drawing based on the given assembly drawing/data.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313311	PRODUCTION DRAWING	PDR	SEC	2	-	4	2	8	4	4	30	70	100	40	25	10	25@	10	25	10	175

PRODUCTION DRAWING **Course Code : 313311**

Total IKS Hrs for Sem. : Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

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

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Construct an auxiliary view of a given object. TLO 1.2 Construct an incomplete principal view from the given auxiliary view.	**Unit - I Auxiliary View** 1.1 Auxiliary planes and views. 1.2 Draw Auxiliary view from the given orthographic views. 1.3 Complete the partial view from the given auxiliary and other principal view.	Lecture Using Chalk-Board Model Demonstration Video Demonstrations
2	TLO 2.1 Use IS SP-46 codes for preparing production drawing. TLO 2.2 Prepare production drawing using standard conventions.	**Unit - II Conventional representation** 2.1 Engineering Material Conventions 2.2 Conventional breaks in pipes, rod and shaft 2.3 Conventional representation of common features like slotted head, radial rib, knurling, serrated shaft, splined shaft, ratchet and pinion, repeated parts, square on shaft, holes on circular pitch, internal and external threads 2.4 Conventional representation of standard parts like ball and roller bearing, gears, springs 2.5 Pipe joints and valves 2.6 Counter sunk and counter bored holes 2.7 Tapers	Lecture Using Chalk-Board Model Demonstration Video Demonstrations

PRODUCTION DRAWING **Course Code : 313311**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Calculate tolerances on the given machine components. TLO 3.2 Identify type of fit between mating parts of machine components based on given tolerance values. TLO 3.3 Prepare production drawing using suitable convention and codes.	**Unit - III Production Drawing** 3.1 Limits, Fits and Tolerances: Definitions, introductions to ISO system of Tolerance. Dimensional tolerances: Terminology, selection and representation of dimensional tolerance- number and grade method. Definitions concerning Tolerancing and Limits system, unilateral and bilateral tolerance, Hole and shaft basis systems, Types of fits- Clearance, transition and Interference, Selection of fit for engineering applications. Calculation of limit sizes and identification of type of fit from the given sizes like 50 H7/s6, 30 H7/d9 etc. 3.2 Geometrical Tolerances: Types of geometrical tolerances, terminology for deviation, representation of geometrical tolerance on drawing. 3.3 General welding symbols, length and size of weld, surface contour and finish of weld, all round and site weld, symbolic representation in Engineering practices and its interpretation. 3.4 Machining symbol and surface texture: Indication of machining symbol showing direction of lay, sampling length, roughness grades, machining allowances, manufacturing methods. Representation of surface roughness on drawing.	Lecture Using Chalk-Board Model Demonstration Video Demonstrations
4	TLO 4.1 Identify various components in given detail drawings. TLO 4.2 Identify sequence of assembling it. TLO 4.3 Prepare assembly drawing from given detailed drawing. TLO 4.4 Prepare bill of material.	**Unit - IV Details to assembly** 4.1 Introduction to assembly drawing, accepted norms to be observed for assembly drawings, sequence for preparing assembly drawing, Bill of Material (BOM). 4.2 Couplings: Oldham & Universal couplings. 4.3 Bearing: Foot Step & Pedestal Bearing. 4.4 Lathe: Single (pillar type) and square tool Post. 4.5 Bench vice & Pipe Vice. 4.6 Screw-jack 4.7 Drill Jig	Lecture Using Chalk-Board Model Demonstration Video Demonstrations
5	TLO 5.1 Interpret various components in given assembly drawings. TLO 5.2 Identify sequence of dismantling in given assembly drawing. TLO 5.3 Prepare the detailed drawing from given assembly drawing.	**Unit - V Assembly to Details** 5.1 Basic principles of process of dismantling the assembly into components. 5.2 Couplings: Oldham & Universal couplings. 5.3 Bearing: Foot Step & Pedestal Bearing. 5.4 Lathe: Single (pillar type) and square tool Post. 5.5 Bench vice & Pipe Vice. 5.6 Screw-jack 5.7 Drill Jig	Lecture Using Chalk-Board Model Demonstration Video Demonstrations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

PRODUCTION DRAWING **Course Code : 313311**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Draw an auxiliary view from given drawing.	1	*Draw an auxiliary view or complete given partial drawing. (any two)	4	CO1
LLO 2.1 Draw an auxiliary view from given drawing.	2	*Draw an auxiliary view or complete given partial drawing. (Continue Sr No 1)	4	CO1
LLO 3.1 Prepare drawing using convention and code as per IS-SP46.	3	*Draw various conventional representations as per IS SP-46	4	CO2
LLO 4.1 Use various tolerances and symbols in drawing.	4	*Draw Dimensional and Geometrical Tolerances, Welding Symbols, Surface Roughness and Machining Symbols on the given figures.	4	CO2 CO3
LLO 5.1 Use various tolerances and symbols in production drawing.	5	Develop Production drawing of machine components showing dimensional and geometrical Tolerance, surface finish etc. (any two)	4	CO2 CO3
LLO 6.1 Draw assembly drawing using standard procedure for assembly of components.	6	Draw an Assembly drawing from the given detailed drawing showing fits, part numbers, bill of material, assembly dimensions (Any one)	4	CO2 CO3 CO4 CO5
LLO 7.1 Draw assembly drawing using standard procedure for assembly of components.	7	Draw an Assembly drawing from the given detailed drawing showing fits, part numbers, bill of material, assembly dimensions. (Sr No 6 continue)	4	CO2 CO3 CO4 CO5
LLO 8.1 Draw assembly drawing using standard procedure for assembly of components.	8	Draw an Assembly drawing from the given detailed drawing showing fits, part numbers, bill of material, assembly dimensions. (Sr No 6 continue)	4	CO2 CO3 CO4 CO5
LLO 9.1 Draw assembly drawing using standard procedure for assembly of components.	9	*Draw an Assembly drawing from the given detailed drawing showing fits, part numbers, bill of material, assembly dimensions. (any one)	4	CO2 CO3 CO4 CO5
LLO 10.1 Draw assembly drawing using standard procedure for assembly of components.	10	*Draw an Assembly drawing from the given detailed drawing showing fits, part numbers, bill of material, assembly dimensions. (Sr No 9 continue)	4	CO2 CO3 CO4 CO5
LLO 11.1 Draw detail drawing using standard procedure for dismantling of given assembly drawing.	11	Draw detailed drawing from the given assembly drawing showing Conventional Representation, Dimensional and Geometrical Tolerances and Surface Finish symbols. (any one)	4	CO2 CO3 CO4 CO5
LLO 12.1 Draw detail drawing using standard procedure for dismantling of given assembly drawing.	12	Draw detailed drawing from the given assembly drawing showing Conventional Representation, Dimensional and Geometrical Tolerances and Surface Finish symbols. (Sr No 11 continue)	4	CO2 CO3 CO4 CO5
LLO 13.1 Draw detail drawing using standard procedure for dismantling of given assembly drawing.	13	Draw detailed drawing from the given assembly drawing showing Conventional Representation, Dimensional and Geometrical Tolerances and Surface Finish symbols. (Sr No 11 continue)	4	CO2 CO3 CO4 CO5

PRODUCTION DRAWING **Course Code : 313311**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 14.1 Draw detail drawing using standard procedure for dismantling of given assembly drawing.	14	*Draw detailed drawing from the given assembly drawing showing Conventional Representation, Dimensional and Geometrical Tolerances and Surface Finish symbols. (any one)	4	CO2 CO3 CO4 CO5
LLO 15.1 Draw detail drawing using standard procedure for dismantling of given assembly drawing.	15	*Draw detailed drawing from the given assembly drawing showing Conventional Representation, Dimensional and Geometrical Tolerances and Surface Finish symbols. (Sr No 14 continue)	4	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)

Micro project

- Prepare assembly drawing/detailed drawing of machine vice/ lathe tailstock/ tool post etc. by visiting Institute's workshop.
- Prepare report on various types of welding symbols used for fabrication work by Visiting nearby fabrication workshop.
- Any other micro-projects suggested by subject faculty on similar line.
- Prepare detailed drawings of Various IC Engine components using proper measuring instruments by visiting Institute's Power engineering Lab or any other.
- Students should collect Production drawings from nearby workshops/industries and establish item reference numbers on that drawing for convention or tolerance value. Prepare report showing item reference numbers and their meaning.
- Prepare report representing conventional representation of various piping joints by visiting nearby process industries like sugar factory, chemical industries, water treatment plant, 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 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.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Models, charts of objects for Auxiliary view.	1
2	Models/ Charts of Conventional representation and Production drawing.	3,4,5

PRODUCTION DRAWING **Course Code : 313311**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
3	Models, charts of assembly and details drawings.	6,7,8,9,10,11,12,13,14,15
4	Drawing equipment and instruments for classroom teaching-large size: a. T-square or drafter (Drafting Machine). b. Set square (45-45-90 and 30-60-90) c. Protector. d. Drawing instrument box (containing set of compasses and dividers). Drawing sheets, drawing pencils H,2H, Eraser, Drawing pins / clips	All
5	Drawing Table with Drawing Board of Full Imperial/ A1 size.	All
6	Set of various industrial drawings being used by industries.	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	Auxiliary View	CO1	4	0	0	8	8
2	II	Conventional representation	CO2	4	6	8	0	14
3	III	Production Drawing	CO3	6	4	8	4	16
4	IV	Details to assembly	CO4	8	0	0	16	16
5	V	Assembly to Details	CO5	8	0	0	16	16
Grand Total				**30**	**10**	**16**	**44**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- continuous assessment based on laboratory performance.

Summative Assessment (Assessment of Learning)

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

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	1	-	-	-	-			
CO2	3	3	1	-	-	-	-			
CO3	3	3	1	-	-	-	-			
CO4	3	2	1	-	-	-	-			
CO5	3	2	1	-	-	-	-			

PRODUCTION DRAWING **Course Code : 313311**

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	October 2003, ISBN: 81-7061-091-2
2	Bhatt, N.D.	Engineering Drawing	Charotar Publishing House, 2011, ISBN: 978-93-80358-17-8
3	Bhatt, N.D.; Panchal, V. M	Machine Drawing	Charotar Publishing House, 2011, ISBN: 978-93-80358-11-6
4	Narayan, K. L. Kannaiah, P. Venkata Reddy, K.	Production Drawing	New Age International Publications, 2011, ISBN: 978-81-224-2288-7
5	Sidheswar, N. Kannaiah, P. Sastry, V.V.S.	Machine Drawing	Tata McGraw Hill Education Private Ltd, New Delhi, 2011, ISBN-13: 978-0-07-460337-6

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/599ThWCvMVA	Auxiliary View
2	https://youtu.be/k7-POcJfjAU	Auxiliary View
3	https://youtu.be/5Pj7vkcolXk	Introduction to working drawing.
4	https://youtu.be/VRi2LMm6jHU	Assembly
5	https://youtu.be/FqzplEaE4Z0	Details to Assembly

Note :

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

MSBTE Approval Dt. 02/07/2024 **Semester - 3, K Scheme**

THERMAL ENGINEERING **Course Code : 313310**

Programme Name/s : **Mechanical Engineering/ Production Engineering**
Programme Code : **ME/ PG**
Semester : **Third / Fourth**
Course Title : **THERMAL ENGINEERING**
Course Code : **313310**

I. RATIONALE

Diploma holders in Mechanical Engineering are expected to take the responsibility for maintaining IC engines, steam boilers, steam turbines, steam condensers, cooling towers and other equipment in steam power plants. Understanding the fundamentals of thermodynamics is crucial to comprehending the operation and maintenance of these devices. This course emphasizes to build the foundation needed for this.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Maintain thermal engineering devices for various industrial / field applications using relevant knowledge & skills related to thermal engineering.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Apply fundamental concepts of thermodynamics to various thermodynamic systems.
- CO2 - Determine various properties of steam using steam table.
- CO3 - Use suitable strategies to maintain steam boiler,steam turbine, steam condenser & cooling towers efficiently.
- CO4 - Select proper heat exchanger for given application.
- CO5 - Identify different components of an I.C. Engine.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313310	THERMAL ENGINEERING	TEG	DSC	3	-	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	175

THERMAL ENGINEERING **Course Code : 313310**

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	TLO 1.1 Explain the various thermodynamic systems & its properties with suitable example. TLO 1.2 Interpret various laws of thermodynamics. TLO 1.3 Maintain various thermodynamic devices by using laws of thermodynamics.	**Unit - I Fundamentals of Thermodynamics** 1.1 Thermodynamic system, Types of systems- Open, closed & isolated system, Extensive and Intensive properties, Process and Cycle. Thermodynamic definition of work, heat, difference between heat and work, flow work, concepts of enthalpy and entropy. 1.2 Laws of Thermodynamics - Zeroth law, first law and second law of thermodynamics. Kelvin Planks, Clausius statements. Concept of Heat engine, Heat pump and Refrigerator. 1.3 Application of Laws of Thermodynamics - Steady flow energy equation and its application to boiler, turbine, and condenser. (No Numerical Treatment on above)	Lecture Using Chalk-Board Presentations Video Demonstrations
2	TLO 2.1 Illustrate Ideal gas processes on P-V & T-S diagram. TLO 2.2 Determine work done, heat transfer, internal energy, enthalpy change for various ideal gas processes. TLO 2.3 Calculate different properties of steam using steam table.	**Unit - II Ideal Gases and Steam Fundamentals** 2.1 Characteristics gas constant and universal gas constant. Derivation of characteristics gas equation. 2.2 Ideal gas processes – Isobaric, Isochoric, Isothermal, Isentropic, Polytropic and their representation on P-V and T-S diagrams. Determination of work, heat, internal energy, enthalpy change. (only simple numerical based on above). 2.3 Steam fundamentals - Applications of steam, generation of steam at constant pressure with representation on T-H & T-S chart. Types of steam: Wet, dry, superheated steam. Properties of steam: Sensible, latent , total heat, specific Volume, dryness fraction. use of steam table. (Only simple numericals based on above). Rankine Cycle & its representation on P-V & T-S chart. (No numerical on Rankine cycle)	Lecture Using Chalk-Board Presentations Video Demonstrations

THERMAL ENGINEERING **Course Code : 313310**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Draw layout of steam power plant. TLO 3.2 Explain construction and working of steam turbines. TLO 3.3 Select condensers for the given situation with justification. TLO 3.4 Explain effective maintenance procedure of steam boiler, steam turbine, steam condenser and cooling tower.	**Unit - III Components of Steam Power Plant** 3.1 Introduction to steam power plant ,Components & layout of steam power plant. Steam Boiler- Definition as per IBR, function , Classification of boilers, Introduction to high pressure boiler , Construction & working of Lamont boiler & Benson Boiler. 3.2 Steam nozzle & Steam Turbines - Function , types , applications of steam nozzles. Steam turbine - Classification , Construction and working of Impulse and Reaction turbine. Need of compounding. Regenerative feed heating & bleeding of steam. 3.3 Steam condensers - Dalton's law of partial pressure, function, classification of condensers, construction and working of surface Condenser. Sources of air leakage and its effect. 3.4 Cooling Towers - Classification of cooling towers, Construction and working of natural, forced and induced draught cooling tower. (No numerical Treatment for this unit)	Lecture Using Chalk-Board Presentations Model Demonstration Video Demonstrations Site/Industry Visit
4	TLO 4.1 Explain modes of heat transfer. TLO 4.2 Calculate heat transfer by conduction through slab & composite walls. TLO 4.3 Select suitable heat exchanger for given application.	**Unit - IV Heat Transfer & Heat Exchangers** 4.1 Modes of heat transfer - Conduction, convection and radiation. Conduction - Fourier's law, conduction through slab & composite wall. Convection - Newton's law of cooling, natural and forced convection. Radiation - absorptivity, transmissivity, reflectivity, emissivity, black body, gray body, Stefan Boltzmann law . (Only simple numerical based on heat transfer by conduction through slab & composite wall.) 4.2 Heat Exchangers - Classification, construction and working of shell and tube, plate type heat exchanger and its applications.	Lecture Using Chalk-Board Presentations Video Demonstrations
5	TLO 5.1 Represent various air standard cycles on P-V & T-S diagram. TLO 5.2 Classify I. C. Engines. TLO 5.3 Explain construction and working of two strokes & four Stroke I.C. engine.	**Unit - V Introduction to I.C. Engine & Power Cycles** 5.1 Power Cycles – Carnot Cycle, Otto cycle, Diesel cycle, Dual Cycle and its representation on P-V and T-S diagram. (No numerical on above) 5.2 Basics of I.C. Engine – Engine terminology, Classification and application of IC engines, Construction & working of two stroke & four stroke I.C. engines (S.I. and C.I.)	Lecture Using Chalk-Board Presentations Model Demonstration Video Demonstrations

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 Measure temperature, pressure, energy, discharge, using instruments such as contact type thermometer, U tube manometer, Rotameter, energy meter.	1	* Use thermometer, pressure gauge, rotameter, energy meter to measure temperature, pressure, discharge and energy.	2	CO1

THERMAL ENGINEERING **Course Code : 313310**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 2.1 Measure parameters required to determine air flow rate. LLO 2.2 Calculate actual volume of air at the suction of reciprocating air compressor.	2	* Measurement of discharge of air using air box.	2	CO2
LLO 3.1 Identify various components of fire tube boiler. LLO 3.2 Show the path of flue gases and water steam circuit.	3	* Trace the path of flue gases and water steam circuit with the help of Fire Tube boiler - Cochran Boiler	2	CO3
LLO 4.1 Identify various components of water tube boiler. LLO 4.2 Show the path of flue gases and water steam circuit.	4	*Trace the path of flue gases and water steam circuit with the help of Water Tube boiler - Babcock & Wilcox Boiler.	2	CO3
LLO 5.1 Identify various components of Boiler Mountings. LLO 5.2 Show the path of flue gases and water steam circuit.	5	*Demonstration & working of Boiler Mountings (Any Two)	2	CO3
LLO 6.1 Identify various components of Boiler accessories. LLO 6.2 Show the path of flue gases and water steam circuit.	6	*Demonstration & working of Boiler Accessories (Any Two)	2	CO3
LLO 7.1 Select turbine model for demonstration. LLO 7.2 Demonstrate the construction and working.	7	Demonstration & working of Impulse & Reaction steam turbine.	2	CO3
LLO 8.1 Select condenser model for demonstration. LLO 8.2 Identify various components of condensers.	8	Demonstration & working of condensers a. Water Cooled condensers. b. Air cooled condensers.	2	CO3
LLO 9.1 Use simulation software. LLO 9.2 Select input parameters to observe the output.	9	Observe simulation of Thermal Power Plant and write specifications of boilers, turbines, condensers and electrical generators.	2	CO3
LLO 10.1 Demonstrate the process of compounding.	10	Illustrate the methods of compounding used in steam turbine.	2	CO3
LLO 11.1 Measure parameters required to determine thermal conductivity. LLO 11.2 Determine the thermal conductivity of metallic rod .	11	*Conduct a trial on conduction set up of metallic rod and calculate thermal conductivity.	2	CO4
LLO 12.1 Measure parameters required to determine Stefan Boltzmann constant. LLO 12.2 Determine Stefan Boltzmann constant .	12	Conduct a trial on Stefan Boltzmann set up and calculate Stefan Boltzmann constant.	2	CO4
LLO 13.1 Identify different heat exchangers available in laboratory. LLO 13.2 Demonstrate the construction and working.	13	Identify different equipments in laboratory having heat exchangers and classify heat exchangers. Write construction and working any 03 of above heat exchangers.	2	CO4
LLO 14.1 Select the proper tools. LLO 14.2 Identify various subassemblies and accessories of engine.	14	*Assembling and dismantling of single cylinder I.C Engine.	2	CO5

THERMAL ENGINEERING **Course Code : 313310**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 15.1 Locate different components of multicylinder I.C. Engine.	15	Identify different components of multicylinder I.C. Engine and write function of each component.	2	CO5

Note : Out of above suggestive LLOs -

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

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

Assignment

- Collect an information about Indian Boiler Regulation act.
- Collect an information about high pressure boilers used in steam power plants. Write a specification and compare each other.
- “High pressure boilers are used in steam power plants” Justify.
- Carry out comparative study of conventional cooling towers, cooling towers used in power plants and upcoming cooling tower.
- Make power point presentation including videos on heat exchangers commonly used.
- Collect an information about manufacturers of I.C. Engine with their specifications.
- Prepare a report on applications of I.C. Engine (S.I/C.I.) in various sectors.

Micro project

- Prepare a model of any one boiler / mounting/accessories with the help of suitable material.
- Prepare charts on compounding, regenerative feed heating processes of steam boiler.
- Collect various components of an I.C. engine and prepare a board model with its details.
- Prepare and present a seminar on boiler instrumentation using appropriate source of information.
- Prepare a report on a visit to Steam Power Plant on the basis of following parameters- a. Layout of power plant b. Specifications & type of – Steam boiler, steam turbine, Steam condenser & cooling tower. c. Construction & working of - Steam boiler, steam turbine, Steam condenser & cooling tower. d. Maintenance procedure of - Steam boiler, steam turbine, Steam condenser & cooling tower. e. List of various parameters controlled for smooth functioning.
- Prepare a model of any one heat exchanger with the help of suitable material.

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.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

THERMAL ENGINEERING **Course Code : 313310**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Mercury or alcohol filled Thermometer, Pressure Gauge Range max up to 8 bars, U- Tube Manometer, Rotameter – Maximum up to 20 LPM .	1
2	Charts / Models demonstrating process of compounding.	10
3	Experimental set up for determination of thermal conductivity of metallic rod consisting of Metallic rod of suitable length adequately insulated with heating arrangements at one end, Voltage regulator, Six thermocouples on metallic rod, Arrangement for cooling other end of rod, Stop watch, Measuring Jar.	11
4	Experimental set up to verify Stefan Boltzmann law.	12
5	Different equipment in power engineering laboratory having heat exchangers.	13
6	Single cylinder I.C. engine suitable for Dismantling and assembling with necessary tool set .	14
7	Test rig of multicylinder I.C. Engine available in laboratory.	15
8	Two stage Reciprocating air compressor with intercooler test rig.	2
9	Cut section models of fire tube boilers.	3
10	Cut section models of water tube boilers.	4
11	Cut section models of various boiler mountings.	5
12	Cut section models of various boiler accessories.	6
13	Cut section models of Impulse & Reaction turbine.	7
14	Cut section models of various water cooled & air-cooled condensers.	8
15	Relevant simulation software.	9

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

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Fundamentals of Thermodynamics	CO1	8	2	4	6	12
2	II	Ideal Gases and Steam Fundamentals	CO2	12	4	4	8	16
3	III	Components of Steam Power Plant	CO3	13	4	6	8	18
4	IV	Heat Transfer & Heat Exchangers	CO4	6	2	4	6	12
5	V	Introduction to I.C. Engine & Power Cycles	CO5	6	2	4	6	12
Grand Total				**45**	**14**	**22**	**34**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- • Two-unit tests of 30 marks and average of two-unit tests. • For laboratory learning 25 Marks • For Self Larning 25 Marks

Summative Assessment (Assessment of Learning)

- • End semester assessment of 25 marks for laboratory learning. • End semester assessment of 70 marks.

XI. SUGGESTED COS - POS MATRIX FORM

THERMAL ENGINEERING **Course Code : 313310**

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1	-	1	-	1	1			
CO2	3	1	-	1	-	1	1			
CO3	3	1	-	1	-	1	1			
CO4	3	1	-	1	-	1	1			
CO5	3	1	-	1	-	1	1			

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	R.K. Rajput	Engineering Thermodynamics	Laxmi Publications, New Delhi 2007, ISBN: 978-0-7637-8272-63678
2	Mahesh M. Rathore	Thermal Engineering	Tata McGraw-Hill Education, New Delhi 2010, ISBN: 978-0-07068113-2
3	P.K. Nag	Basic and Applied Thermodynamics	Tata McGraw-Hill Education, New Delhi ISBN: 978-0070151314
4	S. Domkundwar, C.P. Kothandaraman, A. Domkundwar	A course in Thermal Engineering	Dhanpat Rai and company, New Delhi, 2004, ISBN:9788177000214
5	R.S.Khurmi & J.K.Gupta	A Textbook of Thermal Engineering	S.Chand Limited New Delhi 2022 , ISBN: 978-93-550-1054-4
6	V. Ganeshan	Internal Combustion Engines	Tata McGraw Hills, New Delhi. ISBN: 978-1-25-900619-7

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://onlinecourses.nptel.ac.in/noc24_me63/pr view	Fundamentals of thermodynamics
2	https://www.youtube.com/watch?v=3dyxjBwqF-8	Ideal Gas laws & Processes
3	https://www.youtube.com/watch?v=hoQ_hEweT_Y	Fundamentals of steam & steam formation
4	https://www.youtube.com/watch?v=-cr5vfV4YAI	Types of Boilers, Different Cycles in Boiler Operation, Boiler attachment.
5	https://www.youtube.com/watch?v=7w3Qu9KkPvo	Steam Turbine working
6	https://www.youtube.com/watch?v=IcBTfEtS84s	Surface and Jet Condensers
7	https://www.youtube.com/watch?v=Kj_NEUu2xvw	Types and Components of Cooling Tower
8	https://www.youtube.com/watch?v=TsdV_os3N40	Modes of Heat Transfer
9	https://www.youtube.com/watch?v=qO9BrKLKiLE	Types of Heat Exchangers
10	https://www.youtube.com/watch?v=H_RgFXjg-5s	Introduction & classification of I.C. Engine.

THERMAL ENGINEERING **Course Code : 313310**

Sr.No	Link / Portal	Description

Note :

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

MSBTE Approval Dt. 02/07/2024 **Semester - 3 / 4, K Scheme**

FUNDAMENTALS OF PYTHON PROGRAMMING **Course Code : 313007**

Programme Name/s	**: Automobile Engineering./ Mechanical Engineering/ Mechatronics/ Production Engineering/**
Programme Code	**: AE/ ME/ MK/ PG**
Semester	**: Third / Fourth**
Course Title	**: FUNDAMENTALS OF PYTHON PROGRAMMING**
Course Code	**: 313007**

I. RATIONALE

Comprehension of programming languages is crucial for diploma engineering graduates, especially as they engage with various software applications in the mechanical engineering domain. Python, being easy to code, potent, and stands out as an ideal language for introducing computing and problem-solving concepts to beginners. This course enables students to write Python programs and utilize various built-in functions/methods of Python modules/libraries to solve specific problems.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

An ability to prepare python programs for solving simple 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 program designing tools and IDE for python.
- CO2 - Employ python building blocks and data types in the programming.
- CO3 - Implement conditional and looping statements in the python programming.
- CO4 - Implement bult in functions and modules in the python programming.
- CO5 - Use NumPy for performing operations on list and array.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												Total Marks
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313007	FUNDAMENTALS OF PYTHON PROGRAMMING	FPP	AEC	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50

FUNDAMENTALS OF PYTHON PROGRAMMING **Course Code : 313007**

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	TLO 1.1 Describe the functions of different components of computers and peripherals. TLO 1.2 List the applications of computers in the domain of Mechanical Engineering. TLO 1.3 Create flow chart of given programming problem. TLO 1.4 Describe the given feature of Python programming language.	**Unit - I Introduction to Python Programming** 1.1 Revision of Computer Components (CPU, I/O devices) 1.2 Applications of computer and programming languages in Mechanical engineering domain. 1.3 Program Designing Tools: Algorithm, Flow Chart. 1.4 Introduction and Features of Python: Open source, Interactive, Interpreted, Object-oriented, Platform independent etc., Installation & working of IDEs.	Presentations Hands-on
2	TLO 2.1 Use different Python building blocks. TLO 2.2 Describe different data types of Python programming. TLO 2.3 Differentiate normal and container data types of Python programming language. TLO 2.4 Write simple Python programs by taking the user's input to solve expressions.	**Unit - II Python building blocks & data types** 2.1 Python building blocks: Identifiers, Indentation, Comments, Variables, Arithmetic and assignment operators and Expressions. 2.2 Data Types: Integers, float, complex, string and their declaration, data type conversion. 2.3 Accepting input from user: I/O functions. 2.4 Container Types: List, tuple, set and their declaration. 2.5 Write simple python program to display "Welcome" message.	Presentations Hands-on

FUNDAMENTALS OF PYTHON PROGRAMMING **Course Code : 313007**

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 Use basic relational and logical operators in python programs. TLO 3.2 Employ decision control statements in python programs. TLO 3.3 Employ looping statements in python programs.	**Unit - III Python operators and Control flow** 3.1 Relational and Logical operators. 3.2 Decision making statements: if, if-else, if- elif - else statements. 3.3 Looping statements: while loop, for loop, Nested loops. 3.4 Loop manipulation using continue, pass, break statements.	Demonstration Hands-on
4	TLO 4.1 Use built-in functions in Python programs. TLO 4.2 Use built-in modules in Python programs. TLO 4.3 Develop user-defined functions in Python for the given purpose.	**Unit - IV Python functions and modules** 4.1 Functions: Use of built-in functions, data conversion functions, abs, pow, min, max, round, ceil, floor etc. 4.2 Modules: Use of built-in modules- math cmath, random and statistics. 4.3 User-defined function: Function definition, function calling, function arguments and parameter passing, Return statement, scope of variables.	Demonstration Hands-on
5	TLO 5.1 Manipulate the given list. TLO 5.2 Perform different operations on list. TLO 5.3 Use NumPy arrays for faster operations.	**Unit - V List and arrays in python** 5.1 List: define list (one and multi-dimension), accessing, deleting and updating values in list. 5.2 Basic list operations: slicing, repeating, concatenation and iteration. 5.3 NumPy array: Generate NumPy arrays and construct multidimensional arrays.	Demonstration Hands-on

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 Install python IDE. LLO 1.2 Explore the IDE's settings and preferences.	1	Install Python IDE.	2	CO1
LLO 2.1 Draw flow chart for the given problem. LLO 2.2 Write algorithm for the given problem.	2	*Prepare a flow chart and algorithm for simple problem.	2	CO1
LLO 3.1 Use print function to display the message.	3	Write a simple program to display a simple message. (Ex: “Welcome to Python programming”)	2	CO2
LLO 4.1 Write and execute a python program to solve a given expression.	4	Write a simple Python program by taking user’s input to - - find the area of rectangle - find the area or circle.	2	CO2
LLO 5.1 Write and execute a python program.	5	*Write a program to accept value of Celsius and convert it to Fahrenheit.	2	CO2
LLO 6.1 Use the if - else statement in the python program.	6	Write a python program to find whether the given number is even or odd using if - else statement.	2	CO3

FUNDAMENTALS OF PYTHON PROGRAMMING **Course Code : 313007**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 7.1 Implement the if-elif-else statement in the python program.	7	*Write a python program to check whether a input number is positive, negative or zero using if – elif-else statement.	2	CO3
LLO 8.1 Use appropriate decision-making control statement to solve the given problem.	8	Write a program to accept the three sides of a triangle to check whether the triangle is isosceles, equilateral, right angled triangle.	2	CO3
LLO 9.1 Identify suitable loop and conditional statement for the problem. LLO 9.2 Inscribe the loop and conditional statement in the python program.	9	Write a program that allows the user to input numbers until they choose to stop, and then displays the count of positive, negative, and zero numbers entered (Use while loop).	2	CO3
LLO 10.1 Identify suitable looping statement for multiplication table. LLO 10.2 Implement the for loop for the multiplication table.	10	*Write a python program for printing multiplication table of a given number using for loop. (Ex. 12x1=12 12x2=24 …. 12x10=120)	2	CO3
LLO 11.1 Identify a suitable module for importing a given function. LLO 11.2 Use various mathematical functions available in cmath module.	11	*Write a Python program to demonstrate the use of different mathematical functions (Ex. ceiling, floor etc).	2	CO4
LLO 12.1 Use various functions available in statistics module.	12	*Write a python program to find mean, mode, median and standard deviation using statistics module.	2	CO4
LLO 13.1 Use list data type of Python.	13	Write a python program utilizing a list to display the name of a month based on a given month number.	2	CO5
LLO 14.1 Write programs using Multidimensional list in Python.	14	Write a python program to add or subtract two matrices using multidimensional list.	2	CO5
LLO 15.1 Write programs using Multidimensional list in Python.	15	*Write a python program to multiply two matrices using multidimensional list.	2	CO5
LLO 16.1 Perform metrics operation using NumPy Module	16	*Write a python program to multiply two matrices using NumPy.	2	CO5

Note : Out of above suggestive LLOs -

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

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

Micro project

- Not Applicable

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.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer System with all necessary peripherals and internet connectivity.	All
2	Any relevant python IDE like IDLE/PyCharm/VSCode/Jupiter Notebook/Online Python Compiler.	All

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

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Term Work

Summative Assessment (Assessment of Learning)

- Practical

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	2	3	-	-	2			
CO2	2	2	2	3	-	-	2			
CO3	2	2	2	3	-	-	2			
CO4	2	2	2	3	-	-	2			
CO5	2	2	2	3	-	-	2			

FUNDAMENTALS OF PYTHON PROGRAMMING **Course Code : 313007**

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	Kenneth A. Lambert	Fundamentals of Python : First Programs , 2E	Cengage Learning India Private Limited, ISBN: 9789353502898
2	Yashavant Kanetkar, Aditya Kanetkar	Let Us Python - 6th Edition	BPB Publications, ISBN: 9789355515414

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.w3schools.com/python/	Python Programming
2	https://www.tutorialspoint.com/python/index.htm	Python Programming
3	https://www.python.org/	Python Programming
4	https://spoken-tutorial.org/tutorial-search/?search_foss=Pyt	Python Programming

Note :

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

MSBTE Approval Dt. 02/07/2024 **Semester - 3 / 4, K Scheme**

STRENGTH OF MATERIALS **Course Code : 313308**

Programme Name/s	**: Automobile Engineering./ Agricultural Engineering/ Civil Engineering/ Civil & Rural Engineering/ Construction Technology/ Civil & Environmental Engineering/ Mechanical Engineering/ Production Engineering/**
Programme Code	**: AE/ AL/ CE/ CR/ CS/ LE/ ME/ PG**
Semester	**: Third**
Course Title	**: STRENGTH OF MATERIALS**
Course Code	**: 313308**

I. RATIONALE

All civil & mechanical engineering components are subjected to different types of loads and behave in a specific way. Students can able to understand & analyze various types of loads, stresses & strains with regards to the structural behavior of components and materials. This course is a prerequisite for understanding elastic behavior of different engineering materials, structural analysis, machine design, principles and the strengths of various structural elements used in civil & mechanical industries.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Analyze the stresses & strains in the given structural elements using relevant methods.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Calculate the M.I. of the given object using relevant formulae & methods.
- CO2 - Analyze the structural behavior of the given structural components under various loading conditions.
- CO3 - Draw SFD and BMD for the given structural element under given loading conditions.
- CO4 - Determine the bending and shear stresses in beams under different loading conditions
- CO5 - Analyze the direct & bending stresses in the structural members under eccentric loading conditions.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA			
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min		
313308	STRENGTH OF MATERIALS	SOM	DSC	4	-	2	-	6	3	3	30	70	100	40	25	10	-	-	-	-	125	

STRENGTH OF MATERIALS **Course Code : 313308**

Total IKS Hrs for Sem. : 1 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

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

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Calculate Centroid, Moment of Inertia of Plane lamina and radius of gyration of a given lamina. TLO 1.2 Explain Parallel and Perpendicular axes theorems. TLO 1.3 Calculate Moment of inertia of standard solid shapes and hollow shapes. TLO 1.4 Calculate Moment of inertia of composite plane figures such as I, C, T & L sections. TLO 1.5 Understand Moment of inertia for built-up section.	**Unit - I Moment of Inertia** 1.1 Concept of Moment of Inertia, M.I. of plane lamina and radius of gyration of a given lamina. 1.2 Parallel and perpendicular axes theorems (without derivation). 1.3 M.I. of standard basic figures like square, rectangle, triangle, circle, semi-circle, quarter-circle and Hollow Rectangular & Circular sections. (without derivation). 1.4 M.I. of Composite plane figures such as symmetrical and unsymmetrical I-section, channel section, T-section, angle section. Numerical on composite figure consisting of maximum 03 standard shapes. 1.5 Introduction to M.I. for built-up sections. (No numerical). (IKS* Concept of Centre of Gravity & M.I.used in ancient constructions like temples, forts etc.)	Chalk-Board Hands-on Collaborative learning Video Demonstrations Presentations

STRENGTH OF MATERIALS **Course Code : 313308**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Understand concept of stresses and strains in deformable bodies. TLO 2.2 Understand Hook's law, elastic limit, Linear and lateral strain, Poisson's ratio. TLO 2.3 Determine modulus of elasticity, modulus of rigidity and bulk modulus for given material. TLO 2.4 Articulate practical significance of stress- strain curve for given material under given loading conditions for their relevant use. TLO 2.5 Concept of single shear, double shear & punching shear. TLO 2.6 Compute the total deformation for given homogeneous (compound) sections under axial load. TLO 2.7 Determine the stresses in each material for given composite section. TLO 2.8 Compute strain along x, y and z-direction for a given bi-axial or tri-axial stress system. TLO 2.9 Determine volumetric strain & change in volume for given cube or cuboid.	**Unit - II Simple Stresses, Strains & Elastic Constants** 2.1 Concept of elastic body ,definition of stress, strain, Type of stresses & strains. 2.2 Hook's law, elastic limit, Linear and lateral strain, Poisson's ratio. 2.3 Young's Modulus, Shear Modulus, Bulk Modulus & Relation between these three moduli. 2.4 Standard stress strain curve for mild steel bar and Tor steel bar under tension test, Yield stress, proof stress, ultimate stress, breaking stress, and working stress, strain at various critical points, percentage elongation and Factor of safety. 2.5 Shear stress and shear strain, Single shear, Double shear, Punching shear. 2.6 Deformation of body subjected to axial force for uniformed and stepped sections .Deformation of uniform body subjected to forces at its intermediate sections. 2.7 Concept of composite section, stresses induced and load shared by each material under axial loading only.(No numerical on stepped sections). 2.8 Uni-axial, Bi-axial and Tri-axial stress systems. 2.9 Strain in each direction, volumetric strain, change in volume.	- Chalk-Board - Hands-on Collaborative learning - Video - Demonstrations - Presentations
3	TLO 3.1 Enlist Types of Supports & Types of Beams TLO 3.2 Enlist types of loads acting on a beam. TLO 3.3 Understand the relation between SF, BM and rate of loading. TLO 3.4 Draw SFD and BMD for Simply supported beams ,Cantilever beams & overhanging beams. TLO 3.5 Locate point of maximum BM and point of contra-flexure.	**Unit - III Shear Force & Bending Moment** 3.1 Types of Supports: Simple, Hinge, Roller & Fixed and Beams: Cantilever, Simply supported, Roller, Hinge & overhanging beams. 3.2 Types of loads: Concentrated or Point load, Inclined point load & Uniformly Distributed load. 3.3 Meaning of SF and BM, Relation between them, Sign conventions. 3.4 SFD & BMD for Simply Supported, Cantilever and overhanging beams subjected to Vertical point load & UDL only. 3.5 Drawing SFD and BMD, Location of Point of Contra-Shear, maximum BM, Location of Point of Contra-flexure.	Chalk-Board Hands-on Collaborative learning Video Demonstrations Presentations

STRENGTH OF MATERIALS **Course Code : 313308**

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 Understand concept of pure bending , Neutral Axis and radius of gyration of a given lamina and section modulus. TLO 4.2 Determine Moment of Resistance (M.R.) & section modulus (Z) using Flexural Formula. TLO 4.3 Determine the Bending stresses at given location in simply supported & cantilever beams subjected to standard loading cases (Point load & UDL only). TLO 4.4 Compute & draw maximum and average shear stress for rectangular and circular section. TLO 4.5 Draw shear stress distribution diagram for given section across its depth. TLO 4.6 Determine shear stresses in hollow rectangular section.	**Unit - IV Bending and Shear Stresses in beams** 4.1 Theory of pure bending, assumptions in pure bending, Concept of Neutral Axis and section modulus. 4.2 Flexural Equation (without derivation) with meaning of each term used in equation, bending stresses and their nature, bending stress distribution diagram. 4.3 Bending stress variation diagram across depth of given cross section for cantilever and simply supported beams for symmetrical sections only. 4.4 Shear stress equation (without derivation), meaning of each term used in equation, relation between maximum and average shear stress for square, rectangular and circular section (numerical), shear stress distribution diagram. 4.5 Shear stress distribution diagram for square, rectangular, circle, hollow square, hollow rectangular, hollow circle, T- section & symmetrical I- section only. (no numericals) 4.6 Use of shear stress equation for determination of shear stresses in hollow rectangular section.	Chalk-Board Hands-on Collaborative Learning Demonstration Video Presentations
5	TLO 5.1 Explain effect of direct and eccentric loads on columns. TLO 5.2 Draw resultant stress distribution diagram for a compression member subjected to eccentric load about one of its principal axis. TLO 5.3 Write No tension condition for columns, Core of the section for rectangular & circular column. TLO 5.4 Identify the terms radius of gyration, slenderness ratio & effective length for given column with different end conditions. TLO 5.5 Understand the concept of buckling load in columns using Euler's Formula & Rankine's Formula.	**Unit - V Direct and Bending Stresses** 5.1 Introduction to direct and eccentric loads, Eccentricity about one principal axis, nature of stresses. 5.2 Maximum and minimum stresses, resultant stress distribution diagram. Condition for 'No tension' condition(Problems on Column subjected to Eccentric load about one axis only.) 5.3 Limit of eccentricity, core of section for circular cross sections, middle third rule for rectangular section. 5.4 Introduction to compression members, effective length, radius of gyration, slenderness ratio, type of end conditions for columns. 5.5 Buckling (or Crippling) load for columns by Euler's Formula & Rankine's Formula with meaning of each term in it.(No numericals.)	Chalk-Board Collaborative learning Presentations Demonstration Videos

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

STRENGTH OF MATERIALS **Course Code : 313308**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify different components of UTM .	1	*Conduct sample compressive and tensile tests on metal using Universal Testing Machine along with introduction to machine & other tests to be conducted on UTM.	2	CO2
LLO 2.1 Perform Tension test on mild steel as per IS:432(1) .	2	*Tension test on mild steel as per IS:432(1) .	2	CO2
LLO 3.1 Perform tension test on Tor steel as per IS:1608, IS:1139 .	3	Tension test on Tor steel as per IS:1608, IS:1139 .	2	CO2
LLO 4.1 Conduct compression test on sample test piece using Compression Testing Machine .	4	*Compression test on any two metals like Mild Steel, Brass, Al etc. using Compression Testing Machine .	2	CO2
LLO 5.1 Conduct Izod Impact test on given metals as per IS:1598 .	5	*Izod Impact test on any two metals like mild steel/ brass/aluminum/ copper /cast iron etc. as per IS:1598 .	2	CO2
LLO 6.1 Conduct Charpy Impact test on given metals as per IS:1598 .	6	Charpy Impact test on two metals like mild steel/ brass/aluminum/ copper /cast iron etc. as per IS:1757 .	2	CO2
LLO 7.1 Determine Compressive strength of dry and wet bricks .	7	Compressive strength of dry and wet bricks as per IS:3495 (part I), IS:1077 .	2	CO2
LLO 8.1 Perform Single Shear and double shear test on given metals as per IS:5242 .	8	*Single Shear and double shear test on any two metals like Mild steel/ brass/ Al / copper / cast iron etc. as per IS:5242 .	2	CO2 CO4
LLO 9.1 Conduct Compression test on timber section along the grain and across the grain .	9	Compression test on timber section along the grain and across the grain as per IS:2408 .	2	CO1 CO2
LLO 10.1 Plot Shear force and Bending Moment diagrams of beams subjected to different types of loads.	10	*Shear force and Bending Moment diagrams of cantilever, simply supported and overhanging beams for different types of loading . (02 problems on each type of beam) .	4	CO3
LLO 11.1 Conduct Flexural test on timber beam on rectangular section.	11	*Flexural test on timber beam on rectangular section in both orientations as per IS:1708, IS:2408 .	2	CO1 CO4
LLO 12.1 Prepare PPT on Strain Energy. LLO 12.2 Prepare PPT on Thermal Stresses & Thermal Strains.	12	a) Prepare PPT of minimum 05 slides on the concept of Strain Energy & instantaneous stress induced in a material due to gradual, Sudden & impact load. b) Prepare PPT of minimum 04 slides on Thermal Stresses & Thermal Strains.	2	CO2
LLO 13.1 Conduct Flexure test on floor tiles/roofing tiles.	13	Flexure test on floor tiles IS:1237, IS:13630 or roofing tiles as per IS:654, IS:2690 .	2	CO4
LLO 14.1 Determine hardness no. for given metal using Rockwell Hardness Tester.	14	Rockwell Hardness Test on any two Metals like Mild Steel, Brass Copper, Aluminum etc.	2	CO2
LLO 15.1 Determine hardness no for given metals using Brinell Hardness Tester.	15	Brinell hardens test on any two metals like Mild Steel, Brass Copper, Aluminum etc.	2	CO2

STRENGTH OF MATERIALS **Course Code : 313308**

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

Note : Out of above suggestive LLOs -

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

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

Micro project

- Collect the information of Indian Knowledge System (IKS) given in different units.
- Prepare charts of maximum bending moment and shear force values in standard beams.
- Two Numericals on Chimneys (of rectangular and circular cross section) subjected to wind pressure & also draw stress distribution diagram at base of it.
- Draw & identify difference between Bending stress distribution & Shear stress distribution diagrams for square, rectangular, circle, hollow square, rectangular, circle, T- section, & symmetrical I- section.

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.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Extensometer with least count 0.01mm, maximum extension 25 mm with dial gauge/ digital display suitable for various gauge length.	1,2,3
2	Accessories: Vernier caliper, meter scale, weighing balance, weights, punch, file, hammer, screw driver, pliers, etc.	1,2,3,4,5,6,7,8,9,11,13
3	Universal Testing Machine of capacity 1000kN, 600 kN / 400 kN, analog type/digital type with all attachments and accessories.	1,2,3,8,11,13
4	Tile flexural testing machine confirming to IS:654, capacity 200 Kg with uniform loading rate of 45 to 55 Kg/minute provided with lead shots .	13
5	Brinell and Rockwell Hardness Test machine .	14,15
6	Compression Testing Machine of capacity 2000 kN / 1000 kN, analog / digital type with all attachments and accessories.	4,7,9
7	Izod/Charpy impact testing machine confirming to IS: 1757.	5,6
8	Hot Air Oven with thermostatic control having temp. range 100 to 105 degree celsius .	7

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	Moment of Inertia	CO1	10	2	4	6	12
2	II	Simple Stresses, Strains & Elastic Constants	CO2	16	6	8	4	18
3	III	Shear Force & Bending Moment	CO3	14	2	4	10	16
4	IV	Bending and Shear Stresses in beams	CO4	10	2	4	6	12
5	V	Direct and Bending Stresses	CO5	10	2	4	6	12
Grand Total				**60**	**14**	**24**	**32**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two-unit tests of 30 marks each will be conducted and average of two-unit tests considered. • For formative assessment of laboratory learning 25 marks • Each practical will be assessed considering appropriate % weightage to process and product and other instructions of assessment.

Summative Assessment (Assessment of Learning)

- Pen and Paper Test (Written 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	3	3	2	2	1	--	2			
CO2	3	3	3	3	1	--	3			
CO3	3	3	2	1	1	--	2			
CO4	3	3	2	1	1	---	2			
CO5	3	3	2	1	1	--	2			

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Khurmi R.S., Khurmi N.	A Textbook of Strength of Materials	S. Chand and Co. Ltd. New Delhi, 2019, ISBN 9789352833979

STRENGTH OF MATERIALS **Course Code : 313308**

Sr.No	Author	Title	Publisher with ISBN Number
2	Ramamrutham S.	Strength of Materials	Dhanpat Rai and sons, New Delhi, 2015, ISBN 9788187433545
3	Punmia B. C., Ashok Kumar Jain , Arun Kumar Jain .	Mechanics of Materials	Laxmi Publications (p) Ltd. New Delhi, 2017, ISBN-13: 978-8131806463
4	Rattan S.S.	Strength of Materials	McGraw Hill Education; New Delhi 2017, ISBN-13: 978-9385965517
5	Rajput R. K .	A Textbook of Strength of Materials	S. Chand Publishing 9789352533695, 9352533690

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://youtu.be/DzyIEz3dKXQ?si=beGDRqJ1olZ70LUe	Concept of Stress and Strain .
2	https://youtu.be/RSlmDKHDMUY?si=FHCxXE1QSaa0FqBn	Standard stress-strain curve for mild steel bar and Tor steel bar .
3	https://www.youtube.com/watch?v=MFZ18Ed4HI8	Field Test on TMT .
4	https://www.youtube.com/watch?v=C-FEVzI8oe8	Concept of SFD and BMD .
5	https://www.youtube.com/watch?v=yvbA4mk36Kk	Practical examples of SFD and BMD.
6	https://www.youtube.com/watch?v=f2eGwNUopws	Concept & Numerical on Point of Contraflexure .
7	https://www.youtube.com/watch?v=f08Y39UiC-o	Bending Stresses & Shear Stresses in Beams .
8	https://skyciv.com/structural-software/beam-analysis-softwar e	Calculation & Drawing of SFD & BMD freeware Software .

Note :

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

MSBTE Approval Dt. 02/07/2024 **Semester - 3, K Scheme**

ESSENCE OF INDIAN CONSTITUTION **Course Code : 313002**

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Hotel Management & Catering Technology/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Surface Coating Technology/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ FC/ HA/ HM/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ SC/ TC/ TE/ TR/ TX**
Semester	**: Third**
Course Title	**: ESSENCE OF INDIAN CONSTITUTION**
Course Code	**: 313002**

I. RATIONALE

This course will focus on the basic structure and operative dimensions of Indian Constitution. It will explore various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian Constitution. The Constitution of India is the supreme law of India. The document lays down the framework demarcating the fundamental political code, structure, procedures, powers, and sets out fundamental rights, directive principles, and the duties of citizens. The course on constitution of India highlights key features of Indian Constitution that makes the students a responsible citizen. In this online course, we shall make an effort to understand the history of our constitution, the Constituent Assembly, the drafting of the constitution, the preamble of the constitution that defines the destination that we want to reach through our constitution, the fundamental right constitution guarantees through the great rights revolution, the relationship between fundamental rights and fundamental duties, the futurist goals of the constitution as incorporated in directive principles and the relationship between fundamental rights and directive principles.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry /employer expected outcome – Abide by the Constitution in their personal and professional life.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

ESSENCE OF INDIAN CONSTITUTION **Course Code : 313002**

- CO1 - List salient features and characteristics of the constitution of India.
- CO2 - Follow fundamental rights and duties as responsible citizen of the country.
- CO3 - Analyze major constitutional amendments in the constitution.
- CO4 - Follow procedure to cast vote using voter-id.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313002	ESSENCE OF INDIAN CONSTITUTION	EIC	VEC	1	-	-	1	2	1	-	-	-	-	-	-	-	-	-	50	20	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	TLO 1.1 Explain the meaning of preamble of the constitution. TLO 1.2 Explain the doctrine of basic structure of the constitution. TLO 1.3 List the salient features of constitution. TLO 1.4 List the characteristics of constitution.	**Unit - I Constitution and Preamble** 1.1 Meaning of the constitution of India. 1.2 Historical perspectives of the Constitution of India. 1.3 Salient features and characteristics of the Constitution of India. 1.4 Preamble of the Constitution of India.	Presentations Blogs Hand-outs Modules Flipped classrooms Case studies

ESSENCE OF INDIAN CONSTITUTION **Course Code : 313002**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Enlist the fundamental rights. TLO 2.2 . Identify fundamental duties in general and in particular with engineering field. TLO 2.3 Identify situations where directive principles prevail over fundamental rights.	**Unit - II Fundamental Rights and Directive Principles** 2.1 Fundamental Rights under Part-III. 2.2 Fundamental duties and their significance under part-IV-A. 2.3 Relevance of Directive Principles of State Policy under part-IV A.	Presentations Blogs Hand-outs Modules Case Study Flipped Classroom
3	TLO 3.1 Enlist the constitutional amendments. TLO 3.2 Elaborate the elements of Centre-State Relationship TLO 3.3 Analyze the purposes of various amendments.	**Unit - III Governance and Amendments** 3.1 3.1 Amendment procedure of the Constitution and their types - simple and special procedures. 3.2 The Principle of Federalism and its contemporary significance along with special committees that were setup. 3.3 Major Constitutional Amendment procedure - 1st, 7th, 42nd, 44th, 73rd & 74th, 76th, 86th, 52nd & 91st, 102nd	Cases of Federal disputes with relevant Supreme court powers and Judgements Presentations Blogs Hand-outs Problem based learning
4	TLO 4.1 Explain the importance of electoral rights. TLO 4.2 Write the step by step procedure for process of registration TLO 4.3 Explain the significance of Ethical electoral participation TLO 4.4 Explain the steps to motivation and facilitation for electoral participation TLO 4.5 Enlist the features of the voter's guide TLO 4.6 Explain the role of empowered voter TLO 4.7 Write the steps of voting procedure TLO 4.8 Write steps to create voter awareness TLO 4.9 Fill the online voter registration form TLO TLO 4.10 Follow procedure to cast vote using voter-id.	**Unit - IV Electoral Literacy and Voter's Education** 4.1 Electoral rights , Electoral process of registration 4.2 Ethical electoral participation 4.3 Motivation and facilitation for electoral participation 4.4 Voter's guide 4.5 Prospective empowered voter 4.6 Voting procedure 4.7 Voter awareness 4.8 Voter online registration https:/ /www.ceodelhi.gov.in/ELCdetails.aspx	Presentations Hand-outs Modules Blogs Problem based Learning

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

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

Assignment

- Outline the procedure to submit application for Voter-id
- Assignments are to be provided by the course teacher in line with the targeted COs.

A1. Prepare an essay on Constitution of India .
A2 Prepare a comparative chart of Unique features of Indian Constitution of India and Constitution of USA

- Assignments are to be provided by the course teacher in line with the targeted COs. A1. Prepare an essay on Constitution of India . A2 Prepare a comparative chart of Unique features of Indian Constitution of India and Constitution of USA A3. Self-learning topics: Parts of the constitution and a brief discussion of each part Right to education and girl enrollment in schools. GER of Girls and Boys. Right to equality. Social Democracy. Women Representation in Parliament and State Assemblies. LGBTQIA+

Micro project

- 1. Organize a workshop-cum discussions for spreading awareness regarding Fundamental Rights of the citizen of the country

2. Prepare elaborations where directive principle of State policy has prevailed over Fundamental rights with relevant Supreme Court Judgements.
3. Organize a debate on 42nd, 97th and 103rd Constitutional Amendment Acts of Constitution of India.

Seminar

- 1 Differences in the ideals of Social democracy and Political democracy.

2 Democracy and Women's Political Participation in India.
3 Khap Panchayat - an unconstitutional institution infringing upon Constitutional ethos.
4 Situations where directive principles prevail over fundamental rights.

Group discussions on current print articles.

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- Art 356 and its working in Post-Independent India.
- Women's Resrvation in Panchayat leading to Pati Panchayats - Problems and Solutions.
- Adoption of Article 365 in India.
- Need of Amendments in the constitution.
- Is India moving towards a Unitary State Model ?

Activity

- Arrange Mock Parliament debates.

Prepare collage/posters on current constitutional issues.
i. National (Art 352) & State Emergencies (Art 356) declared in India.
ii. Seven fundamental rights.
iii. Land Reforms and its effectiveness - Case study of West-Bengal and Kerala.

Cases: Suggestive cases for usage in teaching:

- A.K. Gopalan Case (1950) :SC contented that there was no violation of Fundamental Rights enshrined in Articles 13, 19, 21 and 22 under the provisions of the Preventive Detention Act, if the detention was as per the procedure established by law. Here, the SC took a narrow view of Article 21.

Shankari Prasad Case (1951) : This case dealt with the amendability of Fundamental Rights (the First Amendment’s

validity was challenged). The SC contended that the Parliament's power to amend under Article 368 also includes the power to amend the Fundamental Rights guaranteed in Part III of the Constitution.
Minerva Mills case (1980) :This case again strengthens the Basic Structure doctrine. The judgement struck down 2 changes made to the Constitution by the 42nd Amendment Act 1976, declaring them to violate the basic structure. The judgement makes it clear that the Constitution, and not the Parliament is supreme.
Maneka Gandhi case (1978) :A main issue in this case was whether the right to go abroad is a part of the Right to Personal Liberty under Article 21. The SC held that it is included in the Right to Personal Liberty. The SC also ruled that the mere existence of an enabling law was not enough to restrain personal liberty. Such a law must also be "just, fair and reasonable."
Other cases:
1. Kesavananda Bharati Case (1973) : In this case the Hon. SC laid down a new doctrine of the 'basic structure' (or 'basic features') of the Constitution. It ruled that the constituent power of Parliament under Article 368 does not enable it to alter the 'basic structure' of the Constitution. This means that the Parliament cannot abridge or take away a Fundamental Right that forms a part of the 'basic structure' of the Constitution.
2. Mathura Rape Case(1979) : A tribal woman Mathura (aged 14 to 16 years) was raped in Police Custody. The case raised the questions on the idea of 'Modesty of Woman' and here it was was a tribal woman who succumbs to multiple pattiarchies. Custodial rape was made an offence and was culpable with the detainment of 7 years or more under Section 376 of Indian Penal Code. The weight of proofing the allegations moved from the victim to the offender, once sexual intercourse is established. The publication of the victim's identity was banned and it was also held that rape trials should be conducted under the cameras.
3. Puttswamy vs Union of India (2017) : In this landmark case which was finally pronounced by a 9-judge bench of the Supreme Court on 24th August 2017, upholding the fundamental right to privacy emanating from Article 21. The court stated that Right to Privacy is an inherent and integral part of Part III of the Constitution that guarantees fundamental rights. The conflict in this area mainly arises between an individual's right to privacy and the legitimate aim of the government to implement its policies and a balance needs to be maintained while doing the same.
4. Navtej Singh Johar & Ors. v. Union of India (2018) : Hon. SC Decriminalised all consensual sex among adults, including homosexual sex by scrapping down section 377 of the Indian penal code (IPC). The court ruled that LGBTQ community are equal citizens and underlined that there cannot be discrimination in law based on sexual orientation and gender.
5. Anuradha Bhasin Judgement (2020) : The Supreme Court of India ruled that an indefinite suspension of internet services would be illegal under Indian law and that orders for internet shutdown must satisfy the tests of necessity and proportionality. The Court reiterated that freedom of expression online enjoyed Constitutional protection, but could be restricted in the name of national security. The Court held that though the Government was empowered to impose a complete internet shutdown, any order(s) imposing such restrictions had to be made public and was subject to judicial review.

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.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED : NOT APPLICABLE

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	Constitution and Preamble	CO1	4	0	0	0	0
2	II	Fundamental Rights and Directive Principles	CO2	4	0	0	0	0
3	III	Governance and Amendments	CO3	4	0	0	0	0
4	IV	Electoral Literacy and Voter's Education	CO4	3	0	0	0	0
Grand Total				**15**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Assignment, Self-learning and Terms work Seminar/Presentation

Summative Assessment (Assessment of Learning)

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	1	-	-	-	2	-	-			
CO2	1	-	-	-	2	-	-			
CO3	1	2	-	-	2	-	1			
CO4	-	-	-	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	P.M.Bakshi	The Constitution of India	Universal Law Publishing, New Delhi 15th edition, 2018, ISBN: 9386515105 (Check the new edition)
2	D.D.Basu	Introduction to Indian Constitution	Lexis Nexis Publisher, New Delhi, 2015, ISBN:935143446X
3	B. K. Sharma	Introduction to Constitution of India	PHI, New Delhi, 6thedition, 2011, ISBN:8120344197

ESSENCE OF INDIAN CONSTITUTION **Course Code : 313002**

Sr.No	Author	Title	Publisher with ISBN Number
4	MORE READS :	Oxford Short Introductions - The Indian Constitution by Madhav Khosla. The Indian Constitution: Cornerstone of a Nation by Granville Austin. Working a Democratic Constitution: A History by Garnville Austin Founding Mothers of the Indian Republic: Gender Politics of the Framing of the Constitution by Achyut Chetan. Our Parliament by Subhash C. Kashyap. Our Political System by Subhash C. Kashyap. Our Constitution by Subhash C. Kashyap. Indian Constitutional Law by Rumi Pal.	Extra Read
5	B.L. Fadia	The Constitution of India	Sahitya Bhawan,Agra, 2017, ISBN:8193413768

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	http://www.legislative.gov.in/constitution-of-india	Constitution overview
2	https://en.wikipedia.org/wiki/Constitution_of_India	Parts of constitution
3	https://www.india.gov.in/my-government/constitution-india	Constitution overview
4	https://www.toppr.com/guides/civics/the-indian-constitution/the-constitution-of-india/	Fundamental rights and duties
5	https://main.sci.gov.in/constitution	Directive principles
6	https://legalaffairs.gov.in/sites/default/files/chapter%203.pdf	Parts of constitution
7	https://www.concourt.am/armenian/legal_resources/world_constitutions/constit/india/india-e.htm	Parts of constitution
8	https://constitutionnet.org/vl/item/basic-structure-indian-constitution	Parts of constitution

Note :

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

MSBTE Approval Dt. 02/07/2024 **Semester - 3, K Scheme**

COMPUTER AIDED DRAFTING **Course Code : 313006**

Programme Name/s : **Mechanical Engineering/ Production Engineering**
Programme Code : **ME/ PG**
Semester : **Third**
Course Title : **COMPUTER AIDED DRAFTING**
Course Code : **313006**

I. RATIONALE

With the advent of technology, the process of drafting and design has transitioned from manual techniques to digital methods. The study of Computer Aided Drawing and Drafting (CADD) is representing the forefront of this evolution, providing designers with powerful tools to streamline the creation, modification, and visualization of technical drawings.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Create technical drawings using CADD software accurately and efficiently according to industry standards in multidisciplinary teams.

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 commands in CADD software.
- CO2 - Draw complex 2D drawings in CADD software using draw and modify tools.
- CO3 - Draw isometric drawings using CADD software.
- CO4 - Use software to dimension and write text on 2D geometric entities.
- CO5 - Plot given 2D entities using proper plotting parameters in CADD.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
313006	COMPUTER AIDED DRAFTING	CAD	SEC	-	-	4	-	4	2	-	-	-	-	-	25	10	25#	10	-	-	50

COMPUTER AIDED DRAFTING **Course Code : 313006**

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	TLO 1.1 Describe the importance of computer in drafting and designing. TLO 1.2 Set the CADD workspace and interface. TLO 1.3 Prepare drawing using User Coordinate System (UCS) and World Coordinate System (WCS) TLO 1.4 Apply different object selection methods in a given situation. TLO 1.5 Use various commands in application menu bar.	**Unit - I Fundamentals of CAD Drawing** 1.1 Fundamentals of Computer Aided Drafting and its applications, Various Software for Computer Aided Drafting. 1.2 CADD Interface: Application Menu, Quick Access Toolbar, Ribbons, InfoCenter, Command Window, Graphical Area, Status Bar 1.3 CADD initial setting commands: Snap, grid, Ortho, Osnap, Dynamic input, Limits, Units, Ltscale, Object tracking. 1.4 Co-ordinate System- Cartesian and Polar, Absolute and Relative mode, Direct Distance Entry, UCS, WCS. 1.5 Object Selection methods- picking, window, crossing, fence, last and previous. 1.6 Opening, saving and closing a new and existing drawing.	Video Demonstrations Presentations Hands-on
2	TLO 2.1 Use viewing commands. TLO 2.2 Apply formatting commands. TLO 2.3 Draw simple 2D entities using given draw commands. TLO 2.4 Determine coordinates, distance, area, length, centroid of the given 2D entity.	**Unit - II Zoom, Draw, Formatting and Enquiry Commands** 2.1 Zoom Commands – all, previous, out, in, extent, Realtime, dynamic, window, pan. 2.2 Draw Command - Line, Polyline, arc, circle, rectangle, polygon, ellipse, spline, block, hatch. 2.3 Formatting commands - Layers, block, linetype, lineweight, color. 2.4 Enquiry commands – distance, area.	Video Demonstrations Presentations Hands-on

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Draw given complex 2D entities using modify commands. TLO 3.2 Use grip command to manipulate given 2D entity.	**Unit - III Modify and Edit Commands** 3.1 Modify Command - Erase, trim, extend, copy, move, mirror, offset, fillet, chamfer, array, rotate, scale, lengthen, stretch, measure, break, divide, explode, align. 3.2 Editing Objects by Using Grips - Moving, Rotating, Scaling, Mirroring and Stretching.	Video Demonstrations Presentations Hands-on
4	TLO 4.1 Draw isometric entities. TLO 4.2 Draw isometric object from given orthographic views. TLO 4.3 Use Layers for 2D drawings. TLO 4.4 Draw and modify blocks for given 2D entities. TLO 4.5 Use blocks in same and in another given file.	**Unit - IV Isometric Drawings, Layers, and Blocks** 4.1 Isometric drafting- Isometric grid & snap, Isometric axis & plane, Polyline, Isocircle. 4.2 Dimensioning Isometric drawings. 4.3 Text writing on Isometric drawing. 4.4 Layer, Layer properties and applications. 4.5 Blocks: create, modify and use in same file and in another file.	Video Demonstrations Presentations Hands-on
5	TLO 5.1 Use various dimensioning styles to drawn 2D entities. TLO 5.2 Apply Geometric and dimension tolerance symbols on the given entity. TLO 5.3 Write text on given 2D entity. TLO 5.4 Insert table in drawing. TLO 5.5 Prepare new template for drawing as per requirement. TLO 5.6 Plot given 2D entities using proper plotting parameters.	**Unit - V Dimensioning, Text and Plot Commands** 5.1 Dimensioning commands - Dimension styles, Dimensional Tolerances and Geometrical Tolerances, Modify dimension style. 5.2 Text commands - dtext, mtext command. 5.3 Insert table – table, tablestyle command. 5.4 Template Drawing- Standard template, loading template, create new template. 5.5 Plotting a drawing – adding plotter/printer, page setup, plot style commands.	Video Demonstrations Presentations Hands-on

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 basic commands in CADD software. LLO 1.2 Draw 2D entities in CADD software.	1	*Drawing 2-D entities like Line, Polyline, Circle, Rectangle, Polygon and Ellipse by using CADD software.	4	CO1 CO2
LLO 2.1 Use basic commands in CADD software. LLO 2.2 Draw 2D entities in CADD software using Draw commands individually.	2	Drawing simple 2-D objects using any combination of 2 or more commands, like polygon+circle, line+circle, etc.	4	CO1 CO2
LLO 3.1 Use basic commands in CADD software. LLO 3.2 Draw 2D entities in CADD software using Draw, Edit and Modify commands.	3	Drawing complex 2-D objects like pulley/ gear.	4	CO1 CO2

COMPUTER AIDED DRAFTING **Course Code : 313006**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Use basic commands in CADD software. LLO 4.2 Draw 2D entities in CADD software using Draw, Edit and Modify commands. LLO 4.3 Apply dimension and write text on 2D geometric entities.	4	*Drawing complex 2-D object like coupling/joints.	4	CO1 CO2 CO4
LLO 5.1 Use basic commands in CADD software. LLO 5.2 Draw 2D entities in CADD software. LLO 5.3 Apply dimension and write text on 2D geometric entities.	5	* Drawing any two problems of orthographic projections using first angle method of projection.	4	CO1 CO2 CO4
LLO 6.1 Use basic commands in CADD software. LLO 6.2 Draw 2D entities in CADD software. LLO 6.3 Apply dimension and write text on 2D geometric entities.	6	Drawing any two problems of orthographic projections using third angle method of projection.	4	CO1 CO2 CO4
LLO 7.1 Use basic commands in CADD software. LLO 7.2 Draw 2D entities in CADD software. LLO 7.3 Apply dimension and write text on 2D geometric entities.	7	* Drawing any two problems of sectional orthographic projections using First angle method of projection.	4	CO1 CO2 CO4
LLO 8.1 Use basic commands in CADD software. LLO 8.2 Draw 2D entities in CADD software. LLO 8.3 Apply dimension and write text on 2D geometric entities.	8	Drawing any two problems of sectional orthographic projections using third angle method of projection.	4	CO1 CO2 CO4
LLO 9.1 Use basic commands in CADD software. LLO 9.2 Draw 2D entities in CADD software. LLO 9.3 Apply dimension and write text on 2D geometric entities.	9	Drawing any two problems of development of solids.	4	CO1 CO2 CO4

COMPUTER AIDED DRAFTING **Course Code : 313006**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 10.1 Use basic commands in CADD software. LLO 10.2 Draw 2D entities in CADD software. LLO 10.3 Apply dimension and write text on 2D geometric entities.	10	Drawing any two problems on Auxiliary views.	4	CO1 CO2 CO4
LLO 11.1 Use basic commands in CADD software. LLO 11.2 Draw 2D entities in CADD software. LLO 11.3 Apply dimension and write text on 2D geometric entities.	11	*Drawing an assembly drawing from the given detailed drawing showing assembly dimensions, part number and bill of Material.	8	CO1 CO2 CO4
LLO 12.1 Use basic commands in CADD software. LLO 12.2 Draw 2D entities in CADD software. LLO 12.3 Apply dimension and write text on 2D geometric entities.	12	Drawing working drawings from given assembly drawing showing conventional representation, dimensions, geometrical tolerances and machining symbols.	8	CO1 CO2 CO4
LLO 13.1 Use basic commands in CADD software. LLO 13.2 Draw isometric drawings using CADD software.	13	Drawing isometric views of given two objects containing lines, arcs, circles, holes, ribs and slots.	8	CO1 CO3
LLO 14.1 Use basic commands in CADD software. LLO 14.2 Draw isometric drawings using CADD software	14	*Drawing Isometric drawings from given Isometric views and dimension it.	8	CO1 CO3 CO4
LLO 15.1 Use basic commands in CADD software. LLO 15.2 Write text in title block.	15	*Prepare a template for your institute of predefined paper size with title block and institute logo.	4	CO1 CO4
LLO 16.1 Use basic commands in CADD software. LLO 16.2 Take printout by using plot option	16	*Plot the drawings from Sr. 3 to 13 on Paper with title block and institute logo	4	CO1 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)

COMPUTER AIDED DRAFTING **Course Code : 313006**

Not Applicable

- Not Applicable

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.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Networked Licensed latest version of Computer Aided Drafting software.	All
2	CAD workstation with latest configurations for each student.	All
3	Plotter/Printer with latest versions.	All
4	LCD projector and Screen/ Interactive board.	All

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

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

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

Summative Assessment (Assessment of Learning)

- Practical Exam of 25 marks

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	-	-	1	-	-	1			

CO2	2	1	1	-	-	-	1			
CO3	2	1	1	-	-	-	1			
CO4	2	-	-	-	-	-	1			
CO5	1	-	-	1	1	1	1			

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

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Prof. Sham Tickoo	AutoCAD 2021 for Engineers & Designers, Basic & Intermediate	Publisher: BPB Publications, 21 February 2021, ISBN-10: 9389898986, ISBN-13: 978-9389898989
2	Sankar Prasad Dey	Autocad 2014 for Engineers Volume 1	Publisher: Vikas, 21 December 2021, ISBN-13: 978-9325983373
3	Prof. Sham Tickoo	AutoCAD 2024: A Problem-Solving Approach, Basic and Intermediate	Dreamtech Press publication, August 20, 2023, ISBN-10 1640571779, ISBN-13 978-1640571778
4	Kulkarni D.M	Engineering Graphics with AutoCAD	Publisher: Prentice Hall India Learning Private Limited, 1 January 2010, ISBN-10: 8120337832, ISBN-13: 978-8120337831
5	Cadfolks	AutoCAD 2021 For Beginners	Publication: Kishore, 5 May 2020, ISBN-10 819419539X ISBN-13: 978-8194195399
6	Luke Jumper, Randy H. Shih	AutoCAD 2024 Tutorial First Level 2D Fundamentals	SDC Publication, June 27, 2023, ISBN-10 1630575852, ISBN: 978-1-63057-585-4
7	Sharad K. Pradhan, K K Jain	Engineering Graphics , AICTE Prescribed Textbook	Khanna Book Publishing; First Edition, 1 January 2023, ISBN-10 9391505503, ISBN-13 978-9391505509

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.autodesk.com/education/online-learning	Tutorials, courses, and resources for AutoCAD
2	https://www.cadtutor.net/	Tutorials, articles, forums and downloadable resources covering various CAD software applications.
3	https://www.cadin360.com/	Video tutorials, articles, and downloadable resources to enhance CAD skills.
4	https://ocw.mit.edu/courses/mechanical-engineering/	Lectures, assignments and projects covering topics such as engineering design, CAD/CAM, and product development.
5	https://www.engineering.com/LearningCenter/CAD.aspx	Tutorials, articles, and videos covering CAD software, simulation tools, and engineering design concepts.
6	https://www.youtube.com/watch?v=cmR9cfWJRUU	Introductory tutorial for beginners to AutoCAD, covering topics such as interface navigation, basic drawing commands and setting up units and layers.
7	https://www.youtube.com/watch?v=QuR-VKis3jU	2D mechanical drawings in AutoCAD, including drawing parts, adding dimensions, annotations and creating detailed technical drawings.

COMPUTER AIDED DRAFTING **Course Code : 313006**

Sr.No	Link / Portal	Description
8	https://www.youtube.com/watch?v=IWYKfzx-M1E	2D mechanical drawings in AutoCAD, including drawing parts, adding dimensions and annotations, and creating detailed technical drawings.
9	https://www.youtube.com/watch?v=RA0O6AZewTc	Isometric drawings in AutoCAD
10	https://www.youtube.com/playlist?list=PLYEkKxSL5Gt1hR6Jg0ZiQSlc7vn-HTd7h	Isometric drawings in AutoCAD
11	https://www.youtube.com/watch?v=PHSmwXQriIc	Isometric drawings in AutoCAD

Note :

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

MSBTE Approval Dt. 02/07/2024 **Semester - 3, K Scheme**