

# SHRI VISHWAKARMA SKILL UNIVERSITY

(A STATE GOVT SKILL UNIVERSITY ESTABLISHED BY GOVT.OF HARYANA)

Name of the Skill Faculty: Skill Faculty of Engineering &  
Technology

Name of the Programme/Course: B. Voc. (Mechatronics)

With

Industry Partner

Hero MotoCorp

Duration of the course: 6 Semesters/3 Years  
(2024-2027)

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Dr. Meenakshi DR. SATAN  
Program coordinator Programme Coordinator  
B.Voc. Mechatronics B.Voc. M.M. Anand.



Type	No of Hrs	Credit
Theory	15	1
Practical	30	1
On Job training (OJT)	30	1

B. Voc Mechatronics (Batch 2024-2027) Onwards

Semester-Ist

Subject Code	Category	Subject	Credit			Hrs			Theory			Practical			Total		
			L	T	P	L	T	P	I	E	To	I	E	To			
			2	0	2	4	30	0	60	90	15	35	50	35		15	50
24UMEE34 24UMEE35	Disciplinary/ Interdisciplinary Major	Major Course-1 (Measurement & Metrology)	2	0	2	4	30	0	60	90	15	35	50	35	15	50	100
24UMEC01 24UMEC02		Major Course-2 (Basics of Mechatronics)	2	0	2	4	30	0	60	90	15	35	50	35	15	50	100
24UCHM01 24UCHM02	Multidisciplinary	Multidisciplinary-1 (Science I: Applied Chemistry)	2	0	1	3	30	0	30	60	15	35	50	35	15	50	100
24UENG01 24UENG02	Ability Enhancement Courses (AEC)	AEC-1 (English Language and Business Communication)	1	0	1	2	15	0	30	45	15	35	50	35	15	50	100
24UMEE33	Skill Enhancement Courses (SEC)-OJT /Project/Workshop	EDUCAD Lab	0	0	2	2	0	0	60	60	0	0	0	70	30	100	100
24UMEC05 24DYSH01	Value Added Courses	Electrical and Electronics Workshop VAC-1 (Yoga and Health Skills-II)	0	0	2	2	0	0	60	60	0	0	0	70	30	100	100
<b>Total</b>			9	0	10	19	135	0	300	435	90	210	300	280	120	400	700

Dr. Meenakshi  
P.C  
B.Voc Mechatronics  
P.C B.Voc MM Anand

Chairperson  
SDAS (SFET) Dean Engineering  
SVSU  
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Semester-2<sup>nd</sup>

Subject Code	Category	Subject	Credit			Hrs			Theory			Practical			Total		
			L	T	P	L	T	P	I	E	To	I	E	To		(T+P)	
24UMEE42 24UMEE43		Major Course-3 (Hydraulic and Pneumatics)	2	0	2	4	30	0	60	90	15	35	50	35	15	50	100
24UMEE38 24UMEE39	Disciplinary/Interdisciplinary Major	Major Course-4 (Industrial Best Practices)	2	0	2	4	30	0	60	90	15	35	50	35	15	50	100
24UMEC03 24UMEC04		Major Course-5 (Sensors & Transducer)	2	0	2	4	30	0	60	90	15	35	50	35	15	50	100
24UPHY01 24UPHY02	Multidisciplinary	Multidisciplinary-2 (Science 2: Applied Physics)	2	0	1	3	30	0	30	60	15	35	50	35	15	50	100
	Ability Enhancement Courses (AEC)	AEC-2	2	0	0	2	30	0	0	30	30	70	100	0	0	0	100
24UEVS01	Value Added Courses	VAC-2 (Environmental Science)	2	0	0	2	30	0	0	30	30	70	100	0	0	0	100
	Research Project/ Dissertation	Internship	0	0	2	2	0	0	0	60	0	0	0	70	30	100	100
24UMEE41		Total	12	0	9	21	180	0	270	450	120	280	400	210	90	300	700

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Dr. Meenakshi  
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24UMEE34	Measurement & Metrology	L	T	P	C
		2	0	0	2

**Course Objective:**

This course aims to equip students with essential skills and knowledge in measurement and metrology, focusing on practical applications and theoretical understanding.


**Course Outcomes:**

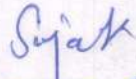
Upon successful completion of this course, students will be able to:

- [CO1] Understand about measurement systems and their components
- [CO2] Utilize various measuring instruments for mechanical measurement.
- [CO3] Apply calibration techniques of measuring instruments.
- [CO4] Understand the basic dimensional and statistical concepts of metrology.
- [CO5] Implement GD&T Principles at shop floor for inspectional accuracy of the job.

Unit	Title	Content	Hr.
1	Introduction to Measurement	Aim, Definition of measurement and metrology, types, related terminologies, accuracy and precision, methods of measurements, units of measurement, Concept of error, sources of error, Measurement standards, calibration of measuring instruments	8
2.	Measuring instruments	Common measuring instruments/gauges- Vernier calliper, micrometre, dial gauge, height gauge, spirit level, slip gauges, surface plate, ring, plug, feeler, thread, radius gauges, Bevel protractor, Sine bar, angle Gauges, Comparators, their types, relative merits and limitation.	6
3	Linear and Angular measurement applications	Gear teeth measurement, Screw thread measurement, Fasteners, Taper & Radius measurement using different measuring instruments.	6
4	Limits, Fit and Tolerance	Limits, Fit and Tolerances: Definitions; Tolerance zone and grades, Hole and shaft system, Geometric tolerances, Tylor's principle of gauging, Design of	5

  
 Dean Engineering  
 Shri Vishwakarma Skill University  
 PC  
 B.Voc Mechatronics

  
 Dr. Meenakshi

  
 DR. SATISH  
 P. C, B.VocMM

  
 Chairperson  
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		tolerances for various applications; Tolerance analysis in manufacturing and assembly	
5	<b>GD&amp;T</b>	Introduction to GD&T parameters- such as straightness, flatness, parallelism, cylindricity etc. Surface finish/surface roughness.	5

**Text Book:**

- Engineering Metrology, R.K. Jain, Khanna Publishers, Delhi, 2009.
- Bewoor & Kulkarni, "Metrology & Measurement" Tata McGraw Hill, 2009.
- D. James, and S. Meadow, "Geometric Dimensioning and Tolerancing", Marcel Dekker, 1995

**Reference Books:**

- Engineering Metrology, Gupta I.C., Dhanpat Rai Publications.
- Engineering Metrology and Measurements, N.V. Raghavendra and L. Krishnamurthy, Oxford University Press.
- Metrology and Measurement, Anand K Bewoor and Vinay A Kulkarni, McG

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 DR. MEENAKSHI  
 PC  
 BVoc Mechatronics  
 DR. SAJAK  
 P.G.D/oc. MM

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 Chairperson  
 SDAS (SFET)  
 SVSU

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 Dean Engineering  
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24UMEE35	Measurement & Metrology Lab	L	T	P	C
		0	0	2	2

### Course Objective:

This course is designed to provide students with hands-on experience of measuring instruments/gauges used in engineering and manufacturing.

### Course Outcomes:

After completing this programme, participants will be able to:

[CO1] Understand various linear and angular measuring instruments.

[CO2] Demonstrate dimensional measurement with linear and angular measuring instruments.

[CO3] Perform Thread ring gauge, Pitch gauge, screw gauge and bevel protector.

[CO4] Demonstrate and use of Feeler gauge, snap gauge, ring gauge, plug gauge, sine bar and slip gauges

[CO5] Perform measurement of gear thread, screw teeth and fastener.

S.No.	Experiment	Hrs.
1	To determine least count of different instruments such as Vernier calliper, micrometre, dial gauge, height gauge etc.	8
2	To demonstrate dimensional measurement of given specimen using linear Measuring Instruments (Vernier callipers, scale, measuring tape, micro-meter, height gauge etc.)	12
3	To inspect different parameters of a given job using instruments/gauges. (Thread ring gauge, Pitch gauge, screw gauge, bevel protector etc)	6
4	To demonstrate the working of various gauges used in industry for inline inspection such as Feeler gauge, snap gauge, ring gauge, plug gauge, Slip gauges and other similar gauges.	6
5	To measure angle of a given specimen using combination sets and Sine bars.	8
6	To perform spindle alignment test on lathe using dial gauge.	8
7	To perform spindle alignment test on milling.	6
8	To check and demonstrate inspection of Outer Diameter and Internal Diameters of given components	6

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Dean Engineering  
Shri Vishwakarma Skill University

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Dr. Meenakshi  
PC  
B.Voc Mechatronics

*Sujak*  
DR. SAJAN  
PC. B.Voc M M

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Chairperson  
SDAS (SFET)  
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24UMEC01	Basics of Mechatronics	L	T	P	C
		2	0	0	2

**Course Objective:**

Introduce fundamental concepts and applications of mechatronics, emphasizing the need for a mechatronics approach in modern systems. Provide foundational knowledge of electrical circuits, machines, motors, and PLCs, enabling students to analyze and implement mechatronic solutions.

**Course Outcomes:**

By the end of this course, the student will be able to:

CO1. Understand the principles of Mechatronics, including its concepts, need, emerging areas, classification, design approaches, and practical applications.

CO2. Apply the principles of DC circuits, including Ohm's Law and Kirchhoff's Law, to solve electrical circuit problems and differentiate between three-phase and single-phase AC circuits.

CO3. Explain the construction, working principles, and applications of various electrical machines, DC motors and induction motors.

CO4. Demonstrate an understanding of stepper and servo motors, including their types, construction, working principles and selection criteria.

CO5. Develop basic PLC programs, understand the structure and components of PLCs, and utilize timers and counters in programming to solve automation problems in industrial applications.

Unit	Title	Content	Hr.
1	Introduction	Introduction to Mechatronics systems, concepts of Mechatronics approach, Need for Mechatronics, Emerging areas of Mechatronics, Classification of Mechatronics system. Components of Mechatronics systems, role various engineering discipline, Traditional & Mechatronics Design concept. Application of mechatronics, advantages &disadvantages of mechatronics system	4
2	Electrical Circuits	Electrical symbol of electrical components, voltage & current source Active & Passive components, Ohm's law, Kirchhoff's Law, Series & Parallel resistive Circuit A.C current and Voltage, difference between A.C and D.C Single phase voltage, three phase voltage, Star & Delta connection	5

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*DR. SAJAN*  
*PC, BDoc MM*

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*Dr. Meenakshi*  
*PC, BDoc Mechatronics*

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3	<b>D.C Electrical actuators</b>	Principle, Construction, Working and application of Electric Motor: DC Motors- PMDC motor, DC shunt Motor, DC series Motor, BLDC Motor, Stepper Motor, servo Motor, selection criteria of motors	7
4	<b>A.C Electrical Actuator</b>	Single phase Motor induction motor: Construction & working, application & disadvantages, Three Phase Induction Motor: Construction & operation, slip and speed Synchronous motor: construction & working , starting methods	7
5	<b>Programmable Logic Controller</b>	Introduction, areas of application of PLC, Basic design of PLC, logic Gates: AND, OR, NOT, NAND, NOR, XOR Input and output processing, Programming of PLC, Timers, counters, Selection of industrial PLC.	7

**Text Books:**

- A Text book of Mechatronics by Er. R.K. Rajput, S Chand Publication, 2022
- System Design – Devdas Shetty & Richard A.Kolk PWS Publication
- Fundamental of Mechatronics -- Prof. C.R. Venkataramana, Sapna Book House
- Basic of Electrical and Electronics Engineering by S.k Sahdev, Dhanpatrai Publications,2013.
- Programmable logic controller by W. Bolton, NEWNES (Elsevier), 4<sup>th</sup> edition

**Reference Books:**

- Mechatronics - Electronics control systems in Mechanical Engineering W.Bolton (Pearson)
- Mechatronics System Fundamentals by R.Isermann, Springer, 2005
- Text Book of Electrical Technology by B. L Theraja, S.Chand Publications,2014

*meenakshi*      *Sanjay*  
 Dr. Meenakshi      DR. SANJAY  
 PC. B.V.O.C Mechatronics, B.V.O.C M.M

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 SDAS (SFETI)  
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 Dean Engineering  
 Shri Vishwakarma Skill University

24UMEC02	Basics of Mechatronics Lab	L	T	P	C
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**Course Objective:**

Providing a focused laboratory environment to apply and absorb Mechatronics concepts.

**Course Outcomes:**

By the end of this course, the student will be able to:

- CO1. Component identification, functional analysis, and application in mechatronic systems.
- CO2. Apply Kirchhoff's Current Law and Kirchhoff's Voltage Law to analyse and solve electrical circuits.
- CO3. Gain practical knowledge of various electrical machines such as induction motors, DC motors, synchronous motors, and single-phase motors
- CO4. Gain comprehensive knowledge of the PLC hardware components, including the CPU, power supply, input/output modules, and communication interfaces. Develop the ability to implement basic logic gate functions using ladder logic programming.

S.No.	Experiments	Hrs.
1	To study & identify various Mechatronics Components	4
2	To identify the active & passive Electrical and Electronics elements	4
3	To verify the Kirchhoff's current Law and Kirchhoff's voltage Law	4
4	To Perform the starting of DC Motor	4
5	To perform the starting of PMDC Motor.	4
6	To Start the Induction Motor using starting Methods namely direct-on-line (DOL) starter and star-delta starter	4
7	To perform the Speed control of a servo Motor.	4
8	To determine the step angle and resolution of a stepper motor.	4
9	To observe the basic operation, including direction of rotation and speed control of PMDC Motor	6
10	To Plot the torque-speed curve for the DC motor under various load conditions and analyze the results.	6
11	To Study the PLC hardware and software.	8
12	Develop basic logic gates function using ladder logic program	8

*Dr. Meenakshi*  
PC  
B.Voc Mechatronics

*Sujak*  
DR. SAJAN  
P.C, B.Voc, MM

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Chairperson  
SDAS (SFET)  
SVSU Dean Engineering  
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24UMEE33	EDUCAD Lab	L	T	P	C
		0	0	2	2

**Course Objective:**

Aim of this course is to understand and escalate the importance of basic concepts and principles of Engineering Drawing. Enable the students with various concepts like dimensioning, conventions and standards related to working drawings in order to become professionally efficient. Ability to read and interpret engineering drawings created by others. Ability to draw orthographic projections

**Course Outcomes:**

After completing this programme, participants will be able to:

[CO1] Identify and use of different grades of pencils and other drafting instruments which are used in engineering field.

[CO2] Utilize various types of lines used in engineering drawing.

[CO3] Construction of scales and diagonal scale, isometric scale, isometric projections and views.

[CO4] Generate isometric (3D) drawing from different 2D (orthographic) views/sketches.

[CO5] Draw projections of point, lines, planes, solids, isometric projections and sections of solids including cylinders, cones, prisms and pyramids using Mini-Dafter and CAD.

[CO6] Use Auto CAD or other drafting software for making fast engineering drawings and even animating the assembly drawings.

Unit	Title	Content	Hr.	No of sheets
1	Introduction to Engineering Drawing	Definition of Engineering Drawing, Introduction to various drawing instruments-materials, layout and drawing sheets and drawing boards, pencil grades. Different types of lines as per BIS specifications, vertical, horizontal and inclined lines. Principles of dimensioning: Types, elements, placing, different methods, Different geometrical figures such as -triangles, rectangles, circles, ellipses, parabola, hexagonal and pentagon. Definition and classification of lettering, different strokes used.	10	04

Dr. Meenakshi  
PC  
Bvoc Mechatronics

Sajak  
DR. SADAN  
P.C, BVoc MM

Chairperson  
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2	<b>Scales, Common Symbols and conventions</b>	Scales-their needs and importance, types of scales, Representative Fraction (R.F.) and length of scale. Construction of Plain and diagonal scale. Material conventions, general symbols used in mechanical/production drawings, Electrical fitting symbols for domestic interior installations, Safety symbols used in engineering works	8	03
3	<b>Orthographic Projection</b>	Basic orthographic projections such as: Projections of points in different quadrants, Projection of line (1st angle and 3rd angle), Line parallel to both planes, Line perpendicular to any one of the principal planes, Line inclined to any one of the principal planes and parallel to other, Projection of Solid-Cube, Cuboid, Cone, Prism, pyramid, Three views of orthographic projections of different objects (At least one sheet in 3rd angle)	16	05
4	<b>Sectional and Isometric Views</b>	Identifications of surfaces, Importance and salient features of sectioning of objects. Description of full section and half section view. Fundamental of isometric projections and isometric scale, Isometric views of different objects.	6	02
5	<b>Graphics using CAD</b>	Meaning, need of computer graphics, CAD, screen structure and toolbars in AutoCAD, coordinate system, Drawing Limits, Units. LINE command, coordinates-Absolute, incremental, polar. POLYLINE, CIRCLE (3P,2P, TTR), ARC, ELLIPSE Different geometrical commands for making figure e.g. triangle, rectangle, hexagon, pentagon, parabola. Editing Commands-Scale, erase, copy, stretch, lengthen and explode. Use of SNAP, GRID and ORTHO mode for selection of points quickly. Use of these modes while picking points in LINE, CIRCLE, PLINE, ARC, ELLIPSE etc commands. Drawing projections of lines and solids. Drawing orthographic projections of different objects (at least 2 sheets) AutoCAD for the isometric views. Making single computer sheet showing all the three views and an isometric (in single split screen view) of any object showing understanding of use of AutoCAD in making isometric views – at least 1 sheet. Draw the various Electrical circuit and panel layout using CAD software.	20	06

**Text Books:**

1. A Text Book of Engineering Drawing by Surjit Singh; Dhanpat Rai & Co., Delhi
2. Engineering Drawing by PS Gill; SK Kataria & Sons, New Delhi
3. Elementary Engineering Drawing in First Angle Projection by ND Bhatt; Charotar Publishing House Pvt. Ltd., Anand
4. Engineering Drawing I & II by JS Layall; Eagle Parkashan, Jalandhar

Dr. Meenakshi  
PC,  
B.Voc Mechatronics

Dr. Surjit  
DR. SAJAN  
P.C., B.Voc MM

Chairperson  
SDAS (SFET)  
SVBU  
Vishwakarma Skill University

24UMEC05	Electrical & Electronics Workshop	L	T	P	C
		0	0	2	2

**Course Objective:**

The objective of this course is to equip students with practical skills and knowledge in handling and troubleshooting electronic and electrical systems.

**Course Outcomes:**

By the end of this course, the student will be able to:

- CO1: Identify and troubleshoot basic electrical issues using multi-meters
- CO2: Assemble and test electronic components on a printed circuit board (PCB)
- CO3: Construct and install a meter board for lighting installations, incorporating safety and protection devices such as energy meters, fuses, MCBs, DP switches, ELCBs, and indicators.
- CO4: Design and implement control circuits for induction motors by using relay
- CO5: Test and diagnose faults in domestic and industrial wiring installations.

S.No.	Experiment	Hrs.
1	Use the multi-meters to measure voltage, current, and resistance.	2
2	Identify and verify the following components: CRO, transformer, function generator, power supply	6
3	To Assembling and testing electronic components on a small PCB.	6
4	To Prepare the following joints: Straight joint, Tee joint, Britannia joint, Western union joint	6
5	To Prepare a meter board for lighting installation using energy meter, fuse, MCB, DP switch ELCB and indicator.	8
6	To Start the single phase induction Motor by using latching of relay.	6
7	Reverse and forward three Phase Motor using relay and contactor	6
8	To control the direction and speed of a motor using relays.	6
9	To Draw wiring plan of the Power circuit for a workshop with machines. (The wiring plan aim to decide the type of wiring system, load calculations, determine the size of conductors, main switch, Isolators, sub switches. Protective devices, cost for circuit wiring).	8
10	To Troubleshoot domestic and industrial wiring installation and repair.	6

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Dr. Meenakshi  
P.C  
Bvoc mechatronics

*Sujak*  
DR. SAJAN  
P.C, BVOUMM

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Chairperson  
SDAS (SFET)  
SVSU

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24UMEE42	Hydraulic and Pneumatics	L	T	P	C
		2	0	0	2

**Course Objective:**

The course aims to teach the fundamentals of hydraulic and pneumatic circuit design and to introduce the industrial hydraulics and pneumatics circuits, their parts, functions and structure.

**Course Outcomes:**

By the end of this course, the student will be able to:

CO1: Able to explain the fluid flow, related properties and basic laws.

CO2: Able to identify and describe the working of various hydraulic components/equipment's.

CO3: Able to illustrate the working of basic industrial circuits in use.

CO4: Able to analyse the use of common pneumatic circuits and their logic.

CO5: To perform basic maintenance and troubleshooting of hydraulic/pneumatic circuits.

Unit	Title	Content	Hr.
1	Introduction to fluids and related properties	Introduction to Fluid, Types of fluids, basic properties of fluids, Newton's law of viscosity, Hydrostatics, continuity and Bernoulli's theorem, Basics of Hydraulics, Pascal's law, advantages and applications of fluid power	4
2	Hydraulic components	Pump Classification – Construction, Working, Advantages, Disadvantages, Performance, Selection criteria, Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning, Control Components: Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Servo and Proportional valves, Basic hydraulic Accessories: Reservoirs, pipes/hoses and their selection	7
3	Hydraulic Circuits and System	Accumulators, Intensifiers, Basic Industrial hydraulic circuits and their working, Electro-hydraulic circuits, Mechanical hydraulic servo-systems.	6
4	Pneumatics and Electro Pneumatics systems	Properties of air, Perfect Gas Laws, air generation and distribution, Selection of Compressor, Filters, Regulator, Lubricator (FRL), Air control Valves: Type, symbols, working, applications and selection, Pneumatic actuators, Introduction to pneumatic logic circuits. Design of Pneumatic circuit – Cascade method – Electro Pneumatic System.	7
5	Troubleshooting and applications	Design of hydraulic circuits for basic applications such as Drilling, Press and Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling in CNC Machine tools. Maintenance: Trouble Shooting and Remedies in Hydraulic and Pneumatic systems.	6

Dr. Meenakshi  
PC  
BVoC Mechatronics

Syad  
DR. SAIJAN  
PC, BVoC MM

Chairperson  
SDAS (SFET)  
SVSU

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### Suggested Readings:

- Fluid Mechanics & Hydraulic Machines, R. K. Rajput, S. Chand Limited
- A Textbook of Fluid Mechanics and Hydraulic Machines, R. K. Bansal
- A Textbook of Fluid Mechanics-R. K Rajput, S. Chand Limited
- Hydraulic and Pneumatic controls-K. Shanmuga Sundaram (S.Chand)
- INTRODUCTION TO HYDRAULICS AND PNEUMATICS- SIVARAMAN, ILANGO (PHI)
- Industrial Hydraulics and Pneumatics- Purushottam Balaso Pawar (Sankalp Publication)

### Reference Books:

- Fundamentals of Pneumatics and Hydraulics- Md. Abdus Salam (Springer)
- Hydraulics and Pneumatics A Technician's and Engineer's Guide-Andrew Parr (BH publications)
- Hydraulics and Pneumatics: Jagadeesha T (Wiley)

*Dr. Meenakshi*  
*PC*  
*BVoc Mechatronics*

*Saijath*  
*PR. SAJAN*  
*PC, BVOLMM*

*Chairperson*  
*SDAS (SFET)*  
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24UMEE43	Hydraulic and Pneumatics Lab	L	T	P	C
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### Course Objective:

To introduce and provide hand on experience to students to design and test hydraulic circuit to Control press, flow etc. To provide hands on experience to design and test the pneumatic circuit to perform basic operations

### Course Outcomes:

After completing this programme, participants will be able to:

By the end of this course, the student will be able to:

CO1: Design and implement meter-in and meter-out valve circuits.

CO2: Comprehend the operation of impulse pilot valves.

CO3: Design circuits using AND & OR logic for double-acting cylinders.

CO4: Design a single cycle automation circuit for double-acting cylinders.

CO5: Test the circuit to ensure correct sequencing (A+B+A-B-).

CO6: Test the operation of both single and double-acting cylinders.

CO7: Design and test circuits using double solenoid valves for double-acting cylinders.

CO8: Understand the function and application of various directional control valves.

S.No.	Experiments	Hrs.
1	Design and Testing of Pneumatic system to Control the Speed of the Cylinder by Meter in and Meter Out Valve Circuit.	4
2	Design and Testing of Impulse pilot operation of single acting cylinder in a Pneumatic Circuits	4
3	Design and Testing of Operation of double acting cylinder with AND & OR logic circuit in a Pneumatic Circuits	4
4	Design and Testing of Pneumatic Circuits Single cycle automation of double acting cylinder using limit switch	4
5	Design and Testing of Pneumatic Circuits Single cycle automation of multiple cylinder in sequence (A+B+A-B-)	4
6	Design and Testing of Electro-Pneumatic Circuits Operation of single and double acting cylinder using single solenoid valve	4
7	Design and Testing of Electro-Pneumatic Circuits Operation of double acting cylinder using double solenoid valve.	4
8	Operation of directional control valves (e.g., 2/2, 3/2, 4/2, 4/3 valves) for single and double acting cylinder in hydraulic.	4
9	Investigate the operation of check valves. Set up a circuit to measure the pressure drop, flow characteristics, and reverse flow prevention provided by check valves.	5

Dr. Meenakshi  
PC  
BUoc Mechanical  
Dr. SATHAN  
PC, BVoC MAS

Chairperson  
SDAS (SFET)  
SVSU

Dean Engineering  
Shri Vishwakarma Skill University

10	Analyse the effect of throttle valves on controlling the speed of a hydraulic cylinder. Measure flow rates, cylinder speeds, and pressure drops across the valve.	5
11	Design a complex hydraulic circuit involving multiple cylinders and valves. Test the circuit's functionality, troubleshoot issues, and optimize performance.	4
12	Simulate the Pneumatic/hydraulic circuit in Auto-Sim/ Fluid-sim of the CNC Milling/Turning machine of our workshop.	6
13	Control of PLC Based Electro Pneumatic Sequencing Circuits.	4
14	Control of PLC Based Electro Hydraulic Sequencing Circuits.	4

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 Dr. Meenakshi  
 PC  
 BVoC Mechatronics

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 PC, BVoCMM

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24UMEE38	Industrial Best Practices	L	T	P	C
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**Course Objective:**

To provide comprehensive knowledge and skills in occupational hazards, ergonomic principles, electrical safety, fire prevention, health considerations, and maintenance schedules in industrial settings, ensuring safety and efficiency in the workplace.

**Course Outcomes:**

By the end of this course, the student will be able to:

CO1: Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.

CO2: Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.

CO3: Present a coherent analysis of a potential safety or health hazard both verbally and in writing, citing the occupational Health and Safety Regulations as well as supported legislation.

CO4: Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.

CO5: Understanding maintenance concepts, functions, and objectives.

CO6: Implementing Time Based Maintenance (TBM) schedules and Failure Based Maintenance (FBM).

Unit	Title	Content	Hr.
1	Occupational Hazard and Control Principles	Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident, its causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation	5
2	Ergonomics at Work Place	Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis – Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations	5
3	Electrical Safety, Fire Prevention and Protection	Electrical PPE, first aid such as in cases of bleeding, burns, choking, electric shock, bandaging procedures. Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers. Detailed concept of 5S and safety used in Industries	6

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 SVSU

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4	<b>Health Considerations at Work Place</b>	Types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability.	6
5	<b>Introduction to Maintenance and Maintenance schedules:</b>	Maintenance Concepts, functions and objectives of maintenance, method of maintenance, Failure Based Maintenance (FBM), Contractual Maintenance, Reliability Centered Maintenance (RCM), Time Based Maintenance (TBM), Condition Based Monitoring (CBM) or Dynamic Predictive Maintenance (DPM), Total Productive Maintenance (TPM), Maintenance scheduling and its importance, scheduling procedure for Break down maintenance and Preventive maintenance	8

#### Text Books:

- Goetsch D. L., (1999), "Occupational Safety and Health for Technologists, Engineers and Managers", Prentice Hall.
- Heinrich H. W., (2007), "Industrial Accident Prevention A Scientific Approach", McGraw-Hill Book Company, National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), Industrial Safety and Pollution Control Handbook.

#### References

- Colling D. A., (1990), "Industrial Safety Management and Technology", Prentice Hall, New Delhi.
- Della D.E., and Giustina, (1996), "Safety and Environmental Management", Van Nostrand Reinhold International Thomson Publishing Inc.

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24UMEE39	Industrial Best Practices Lab	L	T	P	C
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**Course Objective:**

Equip students with the knowledge and skills to identify, implement, and maintain effective safety measures, including personal protective equipment, accident prevention, first aid, electrical, mechanical, and work safety protocols, and conduct hazard identification and risk assessments in industrial settings.

**Course Outcomes:**

CO1: Students will be able to identify and demonstrate the correct usage of various personal protective equipment (PPE) used in different industrial settings, ensuring an understanding of their importance in maintaining personal safety.

CO2: Students will be able to categorize and analyze common types of accidents in industrial environments, understand their causes, and suggest preventive measures to enhance workplace safety.

CO3: Students will gain the skills to identify various types of first aid techniques and their appropriate applications in industrial scenarios, enabling them to respond effectively to workplace injuries and emergencies.

CO4: Students will understand the principles of electrical safety, identify potential electrical hazards, and implement appropriate safety measures to prevent electrical accidents in industrial settings.

S.No.	Experiments	Hrs.
1	Identification and knowledge of different types of personal protective equipment used in Industry.	6
2	To determine different type of accident, occur in industry.	6
3	To determine different types of first aid used in industry.	6
4	To determine different types of electrical safety used in Industry.	6
5	To determine different types of mechanical safety used in Industry.	6
6	To determine different types of work safety used in Industry.	6
7	To determine HIRA (Hazard identification and risk assessment) in industry.	6
8	To develop the check-sheet for a particular example input parameter, output parameter and its impact.	6
9	Organize a workspace following the 5S methodology (Sort, Set in Order, Shine, Standardize, Sustain) and measure improvements in efficiency.	6

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PC, BVoC MM

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SVSU

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Bhaskar Skill University

24UMEC03	Sensors and Transducers	L	T	P	C
		2	0	0	2

**Course Objective:**

The course provides good knowledge of working of different types of sensors used in various application areas. The course also provides knowledge of interfacing of electronic circuits with different sensors for its applications in different fields.

**Course Outcomes:**

By the end of this course, the student will be able to:

CO1. To Understand the concept of sensors and its characteristics.

CO2. Explain and apply physical principles such as electric charges, fields, potentials, capacitance, magnetism, induction, resistance, piezoelectric effect, Hall effect, and temperature properties to the functioning of sensors.

CO3. Select and implement appropriate sensors for specific applications such as area occupancy, motion detection, position, displacement, level measurement, velocity, acceleration, force, strain, tactile sensing, pressure, and temperature sensing.

CO4. To analyse interface electronic circuits including input characteristics, amplifiers, excitation circuits, analog to digital converters, direct digitization and processing, bridge circuits, data transmission, and battery management for low power sensors.

CO5. Gain knowledge of the various materials used in sensors, including semiconductors, metals, ceramics, polymers, and nanomaterials, and understand their properties

Unit	Title	Content	Hr.
1	Introduction	Basics of Measurement, Classification of errors, Error analysis, Static and dynamic characteristics of transducers, Performance measures of transducers and sensors, Classification of sensors and transducers, Sensor calibration techniques, Sensor Output Signal Types.	6
2	Physical Principles of Sensing	Electric Charges, Fields, and Potentials; Capacitance; Magnetism; Induction; Resistance; Piezoelectric Effect; Hall Effect; Temperature and Thermal Properties of Material; Heat Transfer; Light; Dynamic Models of Sensor Elements.	6
3	Interface Electronic Circuits	Input Characteristics of Interface Circuits, Amplifiers, Excitation Circuits, Analog to Digital Converters, Direct Digitization and Processing, Bridge Circuits, Data Transmission, Batteries for Low Power Sensors.	6
4	Sensors in Different Application	Area Occupancy and Motion Detectors; Position, Displacement, and Level; Velocity and Acceleration; Force, Strain, and Tactile Sensors; Pressure Sensors, Temperature Sensors.	6

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5	Sensor Materials and Technologies	Materials, Surface Processing, Nanotechnology	6
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**Text Books:**

- Doebelin, E.O., Measurement systems, Applications and Design, McGraw Hill (2011).
- Nakra, B. C. and Chaudhry, K. K., Instrumentation Measurement and Analysis, Tata McGraw Hill (2008). 87th Senate approved Courses Scheme & Syllabus for B.E. Mechatronics Engg. (2014).
- Murthy, D.V.S., Transducers and Instrumentation, Prentice Hall of India Private Limited (2003).
- Sawhney, A.K., A Course in Electrical and Electronic Measurements and Instrumentation, Dhanpat Rai and Co. (P) Ltd. (2007).

*meenakshi*  
 Dr. Meenakshi  
 PC  
 BVOC Mechatronics

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 DR. SAJAN  
 PC, BVOCMM

*Dr*  
 Chair  
 SDAS  
 SVSU

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 Dean Engineering  
 Shri Vishwakarma Skill University

*Dr. Meenakshi*  
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24UMEC04	Sensors and Transducers Lab	L	T	P	C
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**Course Objective:**

This introduces the students with the theory and methods for conducting experimental work in the laboratory and calibration of various sensors for measuring pressure, temperature, displacement, speed, vibration etc.

**Course Outcomes:**

By the end of this course, the student will be able to:

- CO1: Demonstrate the various contact and non-contact sensors.
- CO2: Analyse and Identify appropriate sensors for given applications.
- CO3: Create a sensor system for given requirements

S.No.	Experiment	Hrs.
1	Speed measurement using inductive pickup/proximity sensor.	4
2	Measurement to temperature using thermocouple	5
3	Measurement to temperature using thermistor	5
4	Measurement to temperature using RTD	5
5	Measurement of displacement using LVDT & Capacitive transducer.	5
6	Measurement of weight using strain gauge.	5
7	Determination of the characteristics of Pressure Sensor and Piezoelectric Force Sensor	5
8	Measurement of displacement using position and velocity measurement using encoders	8
9	Wired the occupancy sensors and measure the impact of occupancy sensors on energy consumption in an office setting.	8
10	Proximity-based Automation: <ul style="list-style-type: none"> <li>• Use proximity sensors to automate tasks based on the presence of an object or person, such as opening doors or activating displays</li> <li>• Detect the presence of non-metallic objects by using Capacitive.</li> <li>• Control a device (e.g., a fan or motor) based on proximity detection</li> </ul>	10

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*DR. MEENAKSHI*  
 PC  
 BVoc Mechatronics

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*DR. SAJAN*  
 PC, B.Tec MM

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 SDAS (SFET)  
 SVSU

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 Dean Engineering  
 Shri Vishwakarma Group University



Course Title	Applied Chemistry	Course No. :	24UCHM01 (Theory) 24UCHM02 (Lab)		
Specialization	Basic Sciences	Structure (LTP)	2	0	1
Offered for	UG (Vocational Courses)	Status	Core ✓	Elective	
Faculty	SFASH	Type	New ✓	Modification	
Pre-requisite	Nil	To take effect from	2024-2025		
Submission date		Date of approval by BoS	23-07-2024		
Course Objective:	The aim of this course is to impart knowledge about the numerous materials used in fabricating and manufacturing devices for the comfort of life. The selection, characterization and suitability assessment of natural raw materials essentially requires principles and concepts of Applied Chemistry. Technology is being increasingly based on the electronic, atomic and molecular level modifications.				
Course Outcome:	<p>By the end of this course, the student will be able to:</p> <p><b>CO1:</b> Understand and analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces</p> <p><b>CO2:</b> Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electron affinity.</p> <p><b>CO3:</b> Understand the classification and general properties of engineering materials such as metal, alloys, glasses, cement, refractory and composite materials using knowledge of chemical bonding.</p> <p><b>CO4:</b> Understand and assess the suitability of water source for domestic and industrial application, effluents and minimize water pollution. Understand corrosion and develop economical prevention technique.</p> <p><b>CO5:</b> Choose fuel and polymers suitable for economical industrial processing to obtain eco- friendly finished products. List major chemical reactions that are used in the synthesis of molecules.</p>				
Contents of the course	<p><b>Unit:1 Chemistry in ancient India and Structure of Atom</b></p> <p>a) <b>Chemistry in ancient India:</b> Historical evidences of Chemistry, a brief introduction to ancient texts in Chemistry (Rasayan Shastra). Maharishi Kanad's concept of Atoms, Metals and metal working Technology (Copper, Gold, Zinc, Iron &amp; Steel).</p> <p>b) <b>Structure of Atom:</b> Rutherford model of atom, Bohr's atomic model, quantum numbers and their significance, de-Broglie equation and Heisenberg uncertainty principle, de-Broglie concepts of dual nature, Heisenberg uncertainty principle and some basic numerical, electronic configuration.</p> <p><b>Unit-2 Periodic Properties &amp; Chemical Bonding</b></p>				

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	<p>Periodic law, periodic table and division of elements into s, p, d and f blocks introduction to properties like atomic radii and volume, ionic radii, ionization energy and electron affinity and their periodicity.</p> <p>Ionic, covalent and coordinate bond and their properties, Metallic bonding (electron cloud model) and properties (like texture, conductance, luster, ductility and malleability).</p> <p><b>Unit-3 Water Chemistry and Corrosion</b>  Impurities in water, methods of removal by filtration using sand beds, hardness of water, its types, causes and removal, disadvantages of hard water, importance of pH value in water usage.</p> <p>Corrosion: Introduction to corrosion, mechanism of corrosion, Factors affecting to corrosion, methods of prevention of corrosion.</p> <p><b>Unit-4 Fuel and their Classification</b>  Definition, characteristics, classification, Calorific value, preparation, composition, properties, and uses-producer gas, water gas, LPG, CNG and oil gas. Petroleum and brief idea of refining into various fractions and their characteristics and uses. Calorific value of fuel.</p> <p><b>Unit-5 Industrial important materials</b>  Polymers: Introduction and classification of polymer. Preparation, properties and uses of Polythene, P.V.C, Nylon, natural and synthetic rubber and phenol-formaldehyde resin and its application in industry.  Brief introduction and application of Fertilizer, Glass, Cements, Refractories.</p>
Textbook	<ol style="list-style-type: none"> <li>1. Engineering Chemistry-I concept and application by Jit Chakraborty, Asimesh Dutta Gupta, Ravikanth Kamlekar</li> <li>2. Dharampal, The Beautiful Tree: Indian Indigenous Education in the Eighteenth Century, Dharampal Classics Series, Rashtrathana Sahitya, Bengaluru, 2021.</li> <li>3. D. M. Bose, S. N. Sen and B. V. Subbarayappa, Eds., A Concise History of Science in India, 2nd Ed., Universities Press, Hyderabad, 2010.</li> <li>4. Dharampal, Indian Science and Technology in the Eighteenth Century: Some Contemporary European Accounts, Dharampal Classics Series, Rashtrathana Sahitya, Bengaluru, 2021.</li> <li>5. Chemistry, Satyaprakash, Khanna Publishing House</li> <li>6. Understanding Chemistry, C.N.R Rao</li> <li>7. Chemistry in Engineering &amp; Tech., Vol. I &amp; II, Rajaram, Kuriacose (TMII)</li> <li>8. Engineering Chemistry, Shashi Chawla (Dhanpat Rai and co.)</li> <li>9. Engineering Chemistry, P.C. Jain, Monica Jain (Dhanpat Rai &amp; Co.)</li> </ol>

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	10. Engineering chemistry, S.S Dara (S.Chand & co.)
References	<ol style="list-style-type: none"> <li>1. A text book of Engineering Chemistry by M. Thirumala Chary, E. Laxminarayana and K. Shashikala.</li> <li>2. Spectroscopy (Vol-4) by K.L. Kapoor</li> <li>3. Hydrogen – A fuel for Automatic Engines, Prashukumar G P, ISTE</li> <li>4. Dr. G. H. Hugar and Prof A. N. Pathak, Applied Chemistry Laboratory Practices, Vol. I and Vol. II, NITTTR, Chandigarh, Publications, 2013-14.</li> <li>5. Agnihotri, Rajesh, Chemistry for Engineers, Wiley India Pvt.Ltd., 2014.</li> <li>6. Jain &amp; Jain, Engineering Chemistry, Dhanpat Rai and Sons; New Delhi, 2015.</li> </ol>
Laboratory Content	<p><u>List of Experiments</u></p> <ol style="list-style-type: none"> <li>1. To determine the viscosity and relative viscosity of given sample by using Ostwald's Viscometer.</li> <li>2. Volumetric estimation of total hardness of given water sample using standard EDTA solution.</li> <li>3. Estimation of total alkalinity of water volumetrically.</li> <li>4. To calculate Biochemical Oxygen Demand (BOD) of the given water sample.</li> <li>5. To calculate Total Dissolved Solids (TDS) present in the given water sample.</li> <li>6. To determine the inorganic nitrogen (Nitrate Nitrogen) in the given water sample.</li> <li>7. To calculate the Total Kjeldahl Nitrogen in the given water sample.</li> <li>8. Proximate analysis of coal: Gravimetric estimation of moisture in given coal sample.</li> <li>9. Determine the pH of given sample using pH meter</li> <li>10. Determination of calorific value of solid or liquid fuel using bomb calorimeter.</li> <li>11. Detection of metal iron in the rust (solution of rust in concentrated HCl may be given).</li> <li>12. Synthesis of a polymer Urea Formaldehyde resin/Phenol Formaldehyde resin.</li> <li>13. Determination of surface tension.</li> <li>14. Determination of residual chloride content of water</li> <li>15. Estimation of Dissolved Oxygen, Dissolved Carbon Dioxide.</li> </ol> <p>Note: Minimum 6-8 Experiments to be performed</p>

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### English Language and Business Communication

Course Code: 24UENG01

Course Credit: 01(1-0-0)  
Max. Marks: 50 (15I+35E)

**Objective:**

To train students to enhance their skills in written as well as oral communication through practical conduct of this course. This course will help students in understanding the principles and techniques of business communication.

**Learning Outcomes:** After completing this course, the learns will be able to

1. Students would be able to understand the nature, structure, types and process of various dimensions of communication and apply them in communication.
2. Students would be able to make effective presentations in various business/professional situations incorporating the ethics of good negotiations and assertive behavior.
3. Students would develop competency to understand and perform the diversity of the globalized-multicultural world.
4. Students would be able to draft various types of documents used inside the organization for various types of communication.
5. Students would develop interview skills and competency incorporating the use of different social media platforms for networking.

Units	Topics
I Basics of Communication	Meaning, Process and Types of Communication; Principles of Effective Communication; Process and types of listening, deterrents to listening process, essentials of good listening.
II Presentation Skills	Prerequisites of effective presentation, format of Presentation.  Negotiations-types, structures and basics of negotiations; Assertive behavior.
III Multicultural World and Communication	Business Communication in a globalized and multicultural world; understanding cultural diversity and developing cultural competency and inter-cultural business communication skills; Barriers to cross-cultural communication and strategies to overcome them.
IV Written Communication	Mechanics of writing, report writing, agenda and minutes; business correspondence – business letter format, style of letter arrangement, types of letters, electronic mail; Resume Writing
V Communication in Practice	Preparing for interviews- types of interviews, process of interview and group discussion; effective ways of performing well in interviews; Social media and Networking, Social media profiles, Editing and Posting on social media;

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### Recommended Readings:

- Bovee, C., & Thill, J.V., and Raina, R.L. *Business Communication Today*. New York: Pearson, 2016.
- Lata, Pushp, and Sanjay Kumar. *Communication Skills*. 2<sup>nd</sup> ed. New Delhi: OUP, 2019.
- Lehman, C. M., Dufrene D. D., and Sinha, M. *BCOM: The South Asian Perspective on Business Communication*. New Delhi: Cengage Learning, 2016.
- Monippally, Matthukutty, M. *Business Communication: From Principles to Practice*. New Delhi: McGraw Hill Pub., 2018.
- Mukerjee, H. S. *Business Communication: Connecting at Workplace*. New-Delhi: Oxford University Press, 2012.
- Murphy, H. A., Hildebrandt, H.W., and Thomas, J.P. *Effective Business Communication*. Boston: McGraw-Hill Companies, 1997.
- Post, Emily. *The Etiquette Advantage in Business*. New York: Collins, 2005.
- Ramesh, Gopaldaswamy, and Mahadevan Ramesh. *The Ace of Soft Skills: Attitude, Communication and Etiquette for Success*. Noida: Pearson, 2019.
- Sandra, M. O. *Handbook of Corporate Communication and Strategic Public Relations: Pure and Applied*. New Delhi: Routledge, 2004.
- Sinha, K. K. *Taxmann's Business Communication*. 4<sup>th</sup> Revised ed. New Delhi: Taxmann's Pub., 2018.
- Taylor, Grant. *English Conversation Practice*. Indian ed. Chennai: McGraw Hill Education Pvt. Ltd., 2017.

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## English Language and Business Communication Practical

Course Code: 24UENG02

Course Credit: 01(0-1-0)  
Max. Marks: 50(35I+15E)

**Objective:** This course is designed to strengthen the communication abilities of the learners by providing them hands-on practice.

**Learning Outcomes:** After completing this course, the learners will be able to

- 1) Demonstrate knowledge and understanding of a range of professional or public communication situations.
- 2) Perform effectively in diverse professional and public communication situations like interviews and negotiations, drafting emails and resume etc.

### Details

- 1) Situational Conversations
- 2) Listening Skills
- 3) Resume Writing
- 4) Mock Interviews
- 5) Group Discussion
- 6) Presentation Skills
- 7) Negotiation Skills
- 8) Email Writing
- 9) Public Speaking
- 10) Extempore Speech

**Note:** The teacher should play the role of the facilitator and allow the learners maximum time to practice these activities. The focus should be primarily on helping the learners overcome the LSWR barrier and gradually move towards honing these skills to enable the learners use them in professional communication situations.

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(U Gradation) For B. Voc/B. Com/BBA/B.Sc.

Course Title – Yoga and Health Skills –II

Course Credit: 02 (L02-T0-P0)

Course code: 24UYHS01  
Max. Marks: 100(30I+70E)

**Objective:** Students will get information about the origin, history and development of Yoga along with different streams of yoga, literature and meditation.

**Learning Outcome:** After the completion of the course, the learners will be able to

1. To make aware of the definition, history and nature of yoga.
2. Telling information about different school of yoga.
3. Giving information about cleansing technique and yogic diet.
4. Explaining the importance of health.
5. Yogic management of various diseases and the utility of meditation.

Unit	Statement
1	<b>Introduction to Yoga:</b> Meaning and Definition of Yoga, Aim and Objectives of Yoga, Misconception of Yoga; Brief knowledge about Streams of Yoga-Ashtang and HathaYoga. Yogic Prayer, Mantra. Importance of Yoga in modern era.
2	<b>Yoga practices:</b> Raja Yoga (AshtangaYoga), GyanYoga, Bhakti Yoga, Karma Yoga, Hatha Yoga.
3	<b>Introduction to cleansing technique:</b> Meaning, Definition, Objectives and Classification. Yogic diet, Diet, Yogic Diet, Anti-diet, Balanced diet.
4	<b>Health:</b> Meaning, Definition, aim and objectives, Dincharya (Daily regimen): Meaning, definition and sequential elements, Application of Dincharya, Ritucharya (Seasonal Regimen): Meaning, Definition, Types with their salient features, Season wise Does and Don'ts.
5	<b>Yogic management in health problems:</b> cervical, back pain, diabetes and stress. <b>Meditation:</b> Meaning, types, importance, general instructions and suggestions for meditation, physical, mental and spiritual effects of meditation.

#### TEXT BOOKS

1. Yoga & yogic chikitsa - Singh Prof. Ramharsh ,Chaukhamba Sanskrit pratishthan, Edition 2011
2. Swami Vivekananda: Jnana Yoga, Bhakti Yoga, Karma Yoga, Raja Yoga, Advaita Ashrama, Calcutta, 2002.
3. Prof. Ramharsh Singh -SwasthavrittaVigyan, Chaukhambha Sanskrit Prakashan, Varanasi, 1998.
4. Sriram Sharma Acharya- JivemSharadahShatam, AkhandJyoti Mathura 1998.
5. Prof. Ramharsh Singh-Yogewam Yogic Chitksha, Chaukhambha Sanskrit Prakashan, Varanasi, 1998.
6. SwasthaVrittaVigyanewam Yogic Chiktsha- Dr. RakeshGiri, SikhshaBharti, Uttrakhand.

#### References Books

1. Swami Kuvalyananda : Asana, Kaivalyadhama, Lonavla, 1993
2. Swami Satyananda Saraswati: Asana, Pranayama, Bandha, Mudra, Bihar School of Yoga, Munger, 2006
3. Basavaraddi, I.V. & others: YOGASANA: A Comprehensive description about Yogasana, MDNIY, New Delhi, 2011.
4. Basavaraddi, I.V. & others: Yogic Sukshma Evam Sthula Vyayama, MDNIY, New Delhi, 2011.

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APPLIED PHYSICS					
B.Voc. (Common for all Branches)					
L	T	P	Credits	Core Course	Internal Examination
2	0	0	2	24UPHY01	: 15
Effective from Session:				2024-25	External Examination
Date of BoS approval:				23-07-2024	: 35
Prerequisite					Total
					: 50
					Duration of Exam
					: 3 Hrs

#### Instruction for Paper Setter:

1. There should be 11 questions in the End Term examinations question paper.
2. The first (1st) question should be compulsory and cover the entire syllabus. This question should be objective, single line answers or short answer type question of total 10 marks.
3. Apart from question 1 which is compulsory, rest of the paper shall consist of 5 units as per the syllabus. Every unit shall have two questions each of 5 marks each. However, the student shall be asked to attempt only one of the two questions in the unit. Individual questions may contain sub-parts / sub-questions.
4. Each Unit shall have a marks weightage of 8.
5. The questions are to be framed keeping in view the learning outcomes of the course / paper. The standard / level of the questions to be asked should be at the level of the prescribed textbook.
6. The requirement of (scientific) calculators / log-tables / data - tables may be specified if required.

#### Objectives

The aim of this subject is to provide the students with the basic concepts of measurement, properties of fluid, laser and fibre optics, Nanoscience etc.

#### Course Outcomes:

After completing this subject, student should be able to:

- CO1. Learn about Indian knowledge system.
- CO2. Understand about properties of matter and thermal physics with examples.
- CO3. To explain the fundamentals of LASER and its applications.
- CO4. To learn the basics of fibre optics and their applications.
- CO5. To explain fundamentals of photo conductivity, Nanoscience along with their practical applications

#### UNIT I:

##### Indian Knowledge System

Physics in Vedas, Atomic theory from Bhagavad-Gita, Indian invention of atomic theory, History of Electricity: From Ancient times to the Modern times, Maharishi Augustaya, History of light, Sound in Vedic Science, Indian Scientist in Physics: Acharya Kanada (Laws of motion), Aryabhata, Sir C. V. Raman, Satyendra Nath Bose, Homi Jahangir Bhabha, Subrahmanyam Chandrasekhar, Vikram Ambalal Sarabhai.

##### Unit-II

Properties of Matter and Thermal Physics: Definition and types of stress and strain, Hooke's law, Fluid properties - density, Specific weight, Specific gravity, Surface tension, Viscosity, Pressure - atmospheric pressure, gauge pressure, absolute pressure, Pascal's law, buoyancy, Introduction to laminar and turbulent flow. Modes of heat transfer- thermal conductivity.

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### UNIT III

Quantum Physics: Inadequacy of classical physics, need for quantum physics, Historical overview, Plank's hypothesis, Quantization of energy, Origin of quantum theory, Photoelectric effect, de Broglie hypothesis – matter waves, Wave-particle duality, Wave-packets, Phase velocity and Group velocity, Experimental evidence of de Broglie's hypothesis: Davisson–Germer experiment, Heisenberg uncertainty principle.

### Unit-IV

Electromagnetic Theory: Faraday's law, Lenz's law, Differential form of Faraday's law expressing curl of electric field in terms of time-derivative of magnetic field and calculating electric field due to changing magnetic fields, energy stored in a magnetic field, displacement current and magnetic field arising from time-dependent electric field, Maxwell's equation in vacuum and non-conducting medium.

### Unit V: Nanoscience and technology

Nanomaterials, types of nanomaterials, properties of nanomaterials, Density of states (0 dimensional, 1-dimensional, 2-dimensional, 3-dimensional), Top-down and bottom up approaches, Characterization of nanomaterials (Scanning Electron microscopes and Transmission electron microscopes).

### Textbook

1. David Griffiths, Introduction to Electrodynamics
2. Nouredine Zettili, Quantum Mechanics: Concepts and Application
3. A. Ghatak, Optics, 7<sup>th</sup> Edition, McGraw Hill Education (India) Pvt Ltd.
4. O. Svelto, Principles of Lasers, 5<sup>th</sup> Edition, Springer.
5. Shotwell, K. Thyagarajan, Introduction to Fiber Optics, 1<sup>st</sup> Edition, Pearson Education India
6. Avadhanulu M. N. and P G Kshirsagar, A Text Book of Engineering Physics, 7<sup>th</sup> Edition, S. Chand
7. H K Malik and A K Singh, Engineering Physics, 2nd Edition, McGraw Hill Education (India) Pvt Ltd.

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MKJ

JK

Applied Physics Lab						
B.Voc. (Common for all Branches)						
L	T	P	Credits	Core Course	Internal Examination	:
0	0	2	1	24UPHY02	External Examination	:
Effective from Session:				2024-025	Total	:
Date of BoS approval:				23-07-2024	Duration of Exam	:
						35
						15
						50
						3 Hrs

#### Objectives:

Students will be able to learn how physics and other disciplines have impacted and continue to impact each other and society.

**Learning Outcomes:** After completion of the course, students will be able to

1. Able to perform experiments of screw jack and worm and worm wheel.
2. Able to determine force constant using Hooke's law
3. Able to perform Bernoulli's theorem.

#### List of Practical's

1. To determine force constant of spring using Hooke's law
2. To determine the Moment of Inertia using a Flywheel.
3. To verify the Bernoulli's Theorem.
4. To study the variation of magnetic field with distance and to find the radius of coil by Stewart and Gee's apparatus.
5. To study the characteristics of Cu-Fe thermo couple.
6. To find the value of Planck's constant by using a photo electric cell.
7. To determine the energy gap of a semiconductor diode.
8. Solar Cell: To study the V-I Characteristics of solar cell.
9. Light emitting diode: Plot V-I and P-I characteristics of light emitting diode.
10. Photoelectric effect: To determine work function of a given material.
11. LASER: To study the characteristics of LASER sources.
12. Optical fibre: To determine the bending losses of Optical fibres.

Note- Experiment may be added as per the curriculum and ability.

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Note: Minimum 8 Experiments to be performed

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M.K.L.

*[Signature]*



Course Title	Environmental Science	Course Code	24UEVS01		
Specialization	Value Added Course/ Audit Course	Structure (LTP)	2	0	0
Offered for	UG	Status	Core <input checked="" type="checkbox"/>	Elective	
Faculty	SFASH	Type	New <input checked="" type="checkbox"/>	Modification	
Credits	2	Marks	Internal	30	
Hours	30		External	70	
Pre-requisite	Nil	To-take effect from	2024-2025		
Submission date	13-07-2024	Date of approval by BoS	23-07-2024		
Course Objective	To develop foundation on principles of environmental studies and concept of structure and function of different compartments of the environment.				
Course Outcome	<p>On completion of this course, students will be able to:</p> <p>CO1: Understand the fundamentals of environmental studies.</p> <p>CO2: Comprehend ecosystems and their dynamics.</p> <p>CO3: Implement corrective measures for the abatement of pollution.</p> <p>CO4: Understand the waste management techniques.</p> <p>CO5: Grasp environmental policies, legislation, and issues.</p>				
Contents of the course	<p><b>Unit 1: Indian Knowledge System- Indigenous Practices, Air &amp; Environment</b>  Environment: Nature, Scope and Importance, Need for Public Awareness. Renewable and Non-Renewable Resources, Atmosphere: Introduction, layers of the atmosphere, Traditional agricultural practices - Organic farming, Crop rotation, Intercropping), Water management techniques - Stepwells, Tankas. Baolis, Forest management and conservation methods - Sacred groves. Agroforestry</p> <p><b>Unit 2: Ecosystems</b>  Concept, Structure and Function of an Ecosystem, Energy Flow in the Ecosystem, Bio-geochemical Cycles, Types of Ecosystem: Forest Ecosystem, Grassland Ecosystem, Desert ecosystem, Aquatic Ecosystems.</p> <p><b>Unit 3: Environmental Pollution</b>  Environmental Pollution: Definition, Causes, Effects and Control Measures. Different Types of Pollutions, Air Pollution, Water Pollution, Soil Pollution, Marine Pollution, Noise Pollution, Thermal Pollution, Environmental issues: Climate change, global warming, acid rain, ozone layer depletion</p> <p><b>Unit 4: Waste Management, Environmental policies and legislation</b>  Solid waste management Municipal solid waste management techniques: Bio Composting, Vermicomposting, Incineration, Landfill sites, Liquid waste management: Waste water and Standards for its discharge given by CPCB, Waste water treatment: Effluent Treatment Plant and Sewage treatment plant (STP), Wildlife Protection Act 1972, Forest Conservation Act 1980, Water (Prevention and control of Pollution) Act 1974, Air (Prevention and Control of Pollution) Act, 1981, Environment Protection Act, 1986</p>				

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Dr. Meenathi

M.K.S.

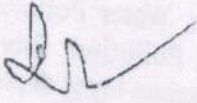
SKM JL

Field Work	<ul style="list-style-type: none"> <li>• Visit to a local area to document environmental assets river/forest/grassland/hill/mountain</li> <li>• Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural</li> <li>• Participation in plantation drive and nature camps.</li> <li>• Campus environmental management activities such as solid waste disposal, water Management and sanitation, and sewage treatment.</li> </ul>
Text Books	<ol style="list-style-type: none"> <li>1. Singh, J.S., Singh, S.P. &amp; Gupta, S.R. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications.</li> <li>2. Odum, E.P., Odum, H.T. &amp; Andrews, J. (1971). Fundamentals of Ecology. Philadelphia: Saunders.</li> <li>3. Gilbert M. Masters and W. P. (2008). An Introduction to Environmental Engineering and Science, Ela Publisher (Pearson).</li> </ol>
References	<ol style="list-style-type: none"> <li>1. Deevedi M. (2021). Environment and ecology in the Indian knowledge system. Vidyanidhi prakashan.</li> <li>2. Melissa K. Nelson and Daniel Shilling. (2018). Traditional Ecological Knowledge: Learning from Indigenous Practices for Environmental Sustainability. Cambridge University Press.</li> <li>3. Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK.</li> <li>4. Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press.</li> <li>5. Central Pollution Control Board Web page for various pollution standards. <a href="https://cpcb.nic.in/standards/">https://cpcb.nic.in/standards/</a></li> <li>6. Ahluwalia, V. K. (2015). Environmental Pollution, and Health. The Energy and Resources Institute (TERI).</li> </ol>

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M.K.L.

