P D A College of Engineering

B.E. in Mechanical Engineering

SchemeofTeachingandExaminations2022

Outcome Based Education(OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

III SEMESTER

Sl. No	Course	Course Code	Course Title	TeachingDepartment (TD)and QuestionPaper SettingBoard(PSB)	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/Drawing	SDA	Duration in hours	CIEMarks	SEEMarks	TotalMarks	
					L	T	P	S					
1	PCC	22ME31	Manufacturing Processes	TD-RespectiveDept. PSB- RespectiveDept.	3	0	0		03	50	50	100	3
2	IPCC	22ME32	Fluid Mechanics & Machines	TD-RespectiveDept. PSB- RespectiveDept.	3	0	2		03	50	50	100	4
3	IPCC	22ME33	Engineering Metrology & Instrumentation	TD-RespectiveDept. PSB- RespectiveDept	3	0	2		03	50	50	100	4
4	PCC	22ME34	Mechanics of Materials	TD-RespectiveDept. PSB- RespectiveDept	2	2	0		03	50	50	100	3
5	PCCL	22MEL35	Manufacturing Process-I Lab	TD-RespectiveDept. PSB- RespectiveDept	0	0	2		03	50	50	100	1
6	ESC	22ME36A	Electric and Hybrid Vehicle Technology	TD:RespectiveDept. PSB:RespectiveDept.	3	0	0		03	50	50	100	3
7	UHV	22UHV37	Social Connect and Responsibility	Any Department	0	0	2		02	50	50	100	1
8	AEC	22MEAE383	Spreadsheet for Engineers	TD and PSB:Concerneddepartment	0	0	2		03	50	50	100	1
9	NCMC	22NS39	Mandatory Course	NSSCoordinator	0	0	2			50	---	50	0
		22PE39	Mandatory Course	PhysicalEducation Director									
		22YO39	Mandatory Course	YogaTeacher									
									Total	**450**	**400**	**850**	**20**

ENGINEERING SCIENCE COURSE (ESC/ETC/PLC)[L-T-P::3-0-0]			
22ME 36A	Electric and Hybrid Vehicle Technology	22ME36C	Internet of Things (IoT)
22ME 36B	Smart Materials & Systems	22ME36D	Waste Management
ABILITY ENHANCEMENT COURSE –III			
22MEAE381	Rapid Prototyping [0-0-2]	22MEAE383	Spreadsheet for Engineers [0-0-2]
22MEAE382	Introduction To Human Factors And Ergonomics [0-2-0]	22MEAE384	Analytical Skills(As)[0-2-0]

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IV SEMESTER

Sl. No	Course and Course Code		Course Title	Teaching Department (TD) and Question Paper Setting Board(PSB)	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical/Drawing	Self-Study	Duration in hours	CIEMarks	SEEMarks	TotalMarks	
					L	T	P	S					
1	PCC	22ME41	Engineering Thermodynamics	TD:ME PSB:ME	2	2	0		03	50	50	100	3
2	IPCC	22ME42	Theory of Machines	TD-RespectiveDept. PSB- RespectiveDept.	3	0	2		03	50	50	100	4
3	IPCC	22ME43	Material Science & Metallurgy	TD-RespectiveDept. PSB- RespectiveDept.	3	0	2		03	50	50	100	4
4	PCCL	22MEL44	Computer Aided Drafting Lab	TD-RespectiveDept. PSB-RespectiveDept.	0	0	2		03	50	50	100	1
5	ESC	22ME45x	**Engineering Science Course**	Respective Dept.PSB:Respective Dept.	3	0	0		03	50	50	100	3
6	BSC	22BSC46	Biology For Engineers	TD/PSB:BT, CHE	3	0	0		03	50	50	100	3
7	UHV	22UHV47	Universal Human Values Course	Any Department	1	0	0		02	50	50	100	1
8	AEC	22XXAE484	Introduction To Python	TD and PSB:Concerneddepartment	0	0	2		03	50	50	100	1
9	NCMC	22NS49	Mandatory Course	NSS coordinator	0	0	2			50	---	50	0
		22PE49	Mandatory Course	Physical Education Director									
		22YO49	Mandatory Course	Yoga Teacher									
									Total	**450**	**400**	**850**	**20**

EngineeringScienceCourse(ESC/ETC/PLC)[L-T-P::3-0-0]			
22ME45A	Non-Traditional Machining	22ME45C	Robotics and Automation
22ME45B	Environmental Studies	22ME45D	Micro Electro Mechanical Systems (MEMS)
AbilityEnhancementCourse /SkillEnhancementCourse-IV			
22MEAE481	Introduction to AI & ML [0-2-0]	22MEAE483	Digital Marketing [0-2-0]
22MEAE482	Introduction To Virtual Reality (0-2-0)	22MEAE484	Introduction To Python[0-0-2]

MANUFACTURING PROCESSES				
Subject Code	22ME31	Credits	03	CIE: 50
Number of LectureHours/Week	3(Theory)			SEE: 50
Total Number of Lecture Hours	42			SEE Hours: 03

Prerequisite:

Course Objectives:

1. Understand the foundry practice
2. Examine plastic deformation and understand metal forming methods
3. Gain insight into the principle of fusion and plastic welding processes and learn newer welding processes
4. Learn to analyze cutting forces and construct merchant circle diagram.
5. Understand the working of continuous and intermittent cutting machine tools and their operations.

Modules	Teaching Hours
Module –I Introduction to manufacturing processes – Primary and secondary manufacturing processes. Foundry: pattern types, allowances, molding sands & their properties, cores. Element of gating system. Shell moulding, die casting.	08 Hours
Module –II Metal forming: Hot and cold working – Rolling, forging and extrusion processes. Explosive forming and electro – hydraulic forming. Powder metallurgy.	08 Hours
Module –III Welding processes: Gas welding: Oxy acetylene gas welding process, Flame characteristics. Arc welding manual metal arc welding, arc cutting. Resistance welding: Spot & seam welding processes. Electron beam and laser beam welding processes.	08 Hours
Module –IV Metal cutting: Tool nomenclature, Tool materials, Taylor's tool life, Orthogonal & Oblique cutting, Mechanism of chip formation, Type of chips. Shear angle equation, Cutting forces, merchant circle diagram – Simple problems	09 Hours
Module –V Machine tools: Lathe, drilling, milling, shaper – Working principle and operations. Surface finishing processes: Grinding, honing, and lapping. Calculation of machining time in Shaper, Lathe and drilling machines.	09 Hours

Question paper pattern:

1. Total of Ten Questions with two from each MODULE to be set covering the entire syllabus.
2. Five full questions are to be answered choosing at least one from each MODULE.
3. Each question should not have more than 3 sub divisions.

Text books:

1. Elements of workshop technology – S.K and A.K HajraChoudary Vol. 1 and Vol. 2 Publisher: Media Promoters and Publishers Pvt. Ltd.

Reference Books:

1. Manufacturing Technology: R.K Rajput Publisher:Laxmi Publications Pvt. Ltd.

At the end of the course students will be able to:	
CO	**Course Outcomes**
CO1	Able to understand foundry practice and gating system.
CO2	Gain knowledge of metal forming and plastic deformation
CO3	Recognize the importance of fusion and plastic welding processes
CO4	Analyze the cutting forces and verify graphically.
CO5	Understand the working of various machine tools and their operations.

Note: CIE FOR 03 CREDIT PROFESSIONAL CORE COURSE

The CIE theory component constitutes of

- CIE IA Test with maximum 25 marks and minimum passing 10 marks
- CIE CCAs with maximum 25 marks and minimum passing 10 marks
- There shall be three Continuous Internal Evaluations (CIE) for the courses with 03credits.
- The CIE Question paper shall be set for a maximum of 30 marks with questions having amaximum of three bits.

The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.

The cumulative marks of the three CIE is to be divided by 3.6 to reduce the final CIE marks to a maximum of 25 marks and the minimum passing mark for this is 10.

Another 25 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests, etc. and the minimum passing mark for this is 10 (If the assessment is mini-project based then only one assessment method may be adopted or otherwise, any two assessment tools may be used.

SEMESTER END EXAMINATION (SEE):

Theory SEE will be conducted by scheduled timetable, with question papers for the subject (duration 03 hrs).
The question paper shall be set for 100 marks.

- The duration of SEE is 03 hours. The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks.
- Students have to answer 5 full questions, selecting one full question from each module.
- The student has to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
- There will be 2 questions from each module. Each of the two questions under a module

FLUID MECHANICS AND MACHINES			
Subject code:	21ME32	Credits: 04	CIE: 50
Number of Lecture hour/week	3		SEE: 50
Total Number of lecture hours	42		SEE-hrs: 03

Course objectives:

The main objective of this subject is

1. To obtain the knowledge of fundamentals of fluid properties, importance of dimensional analysis, losses of energy.
2. Learn about conversion of fluid energy to mechanical energy and vice versa.
3. Understand typical turbo-machines, their working principle, applications, and its analysis.
4. Understand the various aspects of power absorbing machines.

Module-I **Introduction:** Properties of fluids- Mass density, weight density, specific volume, specific gravity, viscosity, Newton's law of viscosity, variation of viscosity with temperature, surface tension, capillarity. Pascal's law, measurement of pressure-manometers. **(Numerical)** **Fluid statics:** Total pressure-horizontal, vertical plane surfaces submerged in a static fluid. Buoyancy, centre of buoyancy, meta centre and meta-centric height. Numerical. **(Numerical)**	09Hours
Module-II **Fluid Kinematics:** Types of flow–steady, unsteady, uniform, non-uniform, laminar, turbulent, one, two, and three dimensional, compressible, incompressible, rotational, irrotational, continuity equation. **Fluid dynamics**: Euler's equation of motion, Bernoulli's equation of ideal fluid. Flow measuring devices-Venturimeter, Orifice meter, V-Notch, And rectangular notch. **(Numerical)**	08Hours
Module-III **Viscous flow:** Flow through circular pipe-Hagen Poiseuille's formula. Derivation. **(Numerical)** **Flow through pipes:** Energy losses in pipes-Major and minor energy losses. **(Numerical)** **Dimensional and model analysis-** Dimensional homogeneity, Bukingham's π–theorem.Reynolds, Froude's. Euler's, Weber's, Mach numbers. **(Numerical)**	09Hours
Module-IV **Introduction to turbo-machines:** Definition, Parts & types of a turbo-machine. Comparison between positive displacement machines. Thermodynamic analysis of turbo-machines. Degree of reaction and its applications for impulse and reaction turbo-machines. **(Numerical)**	08Hours
Module-V **Fluid flow in hydraulic turbines:** Introduction, Components of Pelton wheel, velocity triangles-force, power and efficiency, characteristics of Pelton wheel. **Fluid flow in centrifugal and reciprocating pumps:** Working principle,discharge, Head efficiency and power of pump, work done by the pump, minimum speed of starting a pump, slip and negative slip**.** **(Numerical)**	09 Hours

Question Paper Pattern:

1. Two questions from each module will be set covering entire syllabus.
2. Five full questions are to be answered choosing at least one from each module.
3. Each question should not have more than three sub-divisions.

Text Books:

1. Fluid mechanics and Hydraulic Machines by DR. R K Bansal.
2. Fundamentals of Turbo-machinery by B K Venkanna , PHI Learning (P) Ltd, New Deklhi, 2009.

Reference Books:

1. Fluid Mechanics by Streeter, Wylie, Bedford.
2. Turbines, compressors & Fans by S.M Yahya, Tata Mcgraw Hill Co, 2012
3. E books and online course materials

Course Outcomes:
On completion of the course, the student will have the ability to:

CO#	Course Outcome (CO)
CO1	Understand the properties of fluids, pressure measurement using manometers, Analyze total pressure, Centre of buoyancy forces on plane surfaces.
CO2	Discuss types of flows, fluid flow measurements and to analyze flow through circular pipe.
CO3	Understand the concepts of losses in pipes, dimensional Analysis, and boundary layer flow.
CO4	Understand basics of turbo-machines and Analyze turbo-machines, velocity & Pressure compounding of Steam turbines. Design aspects of Steam turbines.
CO5	Classify, Analyze and understand principles of fluid flow in centrifugal and reciprocating pumps.

FLUID MECHANICS LAB

Course Objectives:

To enable the students to obtain the knowledge of Fluid Mechanics Practical in the following topics,

- Determination of co-efficient of discharge through flow measuring devices.
- Use of manometer for friction factor measurement.
- Difference between laminar flow and turbulent flow.
- Determination of forces on an airfoil.

List of Experiments

S.No	Experiments Name
1.	To determine co-efficient of discharge of Venturimeter.
2.	To determine the co-efficient of discharge of orifice meter.
3.	To determine the co-efficient of discharge of v-notch.
4.	To determine the co-efficient of discharge of rectangular notch.
5.	To determine friction factor for the pipes.
6.	To determine minor losses due to sudden enlargement and sudden contraction.
7.	To determine meta-centric height of a floating body.
8.	To verify Bernoulli's equation for the flow of fluid.
9.	To obtain the Reynolds number in different flow conditions.
10.	To measure the local velocity at a given point in the flow stream by Pitot tube.

Reference Books: 1. Laboratory Manual/ journal for Fluid Mechanics.

At the end of the course students will be able to:

CO	Course Outcomes
CO1	Apply use of Bernoulli's and continuity equation in flow measuring devices.
CO2	Illustrate the measurement of metacentric height.
CO3	Visualize the laminar and turbulent flow.
CO4	Estimation of friction factor of different pipe system.
CO5	Explain the free and forced vortex flow.

CIE AND SEE FOR THE INTEGRATED PROFESSIONAL CORE COURSE (IPCC) WITH 4CREDITS(L-T-P: 3-0-2)

a) CIE THEORY COMPONENT

The CIE theory component constitutes of

- CIE - Internal Assessment Test with maximum 15 marks with minimum passing 6 marks
- CIE - Continuous and Comprehensive Assessment with maximum 10 markswith minimum passing 4 marks

There shall be three Continuous Internal Evaluations (CIE)

- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.
- The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.
- The cumulative marks of the three CIE is to be divided by 6 to reduce the final CIE marks to a maximum of 15 marks and the minimum passing mark for this is 6.
- Another 10 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests, etc, and the minimum passing mark for this is 4. (If the assessment is mini-project based then only one assessment method may be adopted or otherwise, any two assessment tools may be used.
- The laboratory component of the IPCC shall be for CIE only no SEE.

b) CIE PRACTICAL COMPONENT

The CIE practical component constitutes of

- CIE Practical with maximum 15 marks and minimum passing 6 marks
- CIE Practical Test with maximum 10 marks and minimum passing 4 marks
- The maximum marks dedicated for conducting the experiments and preparation of laboratory records is 15 with minimum passing marks 6.
- The final CIE practical test for 50 marks to be conducted after completion of all the experiments and the scored marks is reduced to the maximum of 10 with minimum passing marks 4.

The maximum marks for both CIE theory and Practical is 50 and minimum passing marks is 20

ENGINEERING METROLOGY &INSTRUMENTATION				
Subject Code	22ME33	Credits	04	CIE:50
Number of Lecture Hours/Week	3(Theory)+02(Practical)			SEE:50
TotalNumberof Lecture Hours	42			SEE: Hours:03

Prerequisite: Requiresthebasicknowledgeofthefollowing:

1. MetricandSIunitsofphysicalquantities
2. Statistics
3. Trigonometry

CourseObjectives:

After studying this course, students will be able to:

1. To understand the basic principles of measurements.
2. To familiarize with the fundamentals of limits and limit gauges
3. To understand the working of linear and angular measuring instruments
4. To give idea about various methods for measurement of screw thread and gear
5. To provide idea about principle and applications of devices for measurement of force, torque, pressure, flow and temperature.

MODULES	Teaching Hours
MODULE- I **Introduction to Metrology:** Basics of Metrology - Objectives - process of measurement -Need of inspection- -Methods of measurement. **Standards of measurements:** Role of standards, Types of Standards: line Standard and End Standard, Standards of length , Material Length Standards-International prototype meter, Imperial standard yard. Subdivision of standards, Wave length standard.	8Hours
MODULE–II **Linear Metrology: N**on-precision Instruments and precision Instruments, Slip gauges, wringing phenomena, Indian Standards (M-112, M-87) and building of slip gauges. Calibration of end bars (Numerical). **Limits, Fits, and Tolerances:** Systems of Limits, Fits, Tolerances and Gauging: Principle of Interchangeability, Definition of Tolerance, Types. Terminology for Limits and Fits, definition of fit, Different types of fit, hole basis system and shaft basis system. Introduction to gauges, classification of gauges, design of gauges using Taylor's Principle (Numerical).	9Hours
MODULE–III **Angular measurements:** Introduction, Instruments for angle measurements, Bevel protractor, sine principle and use of sine bars and angle gauges.(Numerical on building of angles). **Comparators:** Need of a comparator,basic principle of operation, characteristics and classification of comparators: Mechanical comparators- Johnson Mikrokator, sigma comparator, Mechanical optical comparators- principles and pneumatic comparators.(At least one each in details).	8 Hours

MODULE–IV **Measurement and Measurement Systems:** Definition, Significance generalized measurementsystem,definition andconcepts ofaccuracy,Precision,calibration, threshold, sensitivity,hysteresis, repeatability, linearity, loading effect, system response-time delay. **Errors in measurements:**Classification of errors-sources of errors. **Measurement of Force, Torque and Pressure:** Introduction, Force: Direct Method-Analytical Balance (Equal arm) Platform Balance. Mechanical Dynamometers, Hydraulic Dynamometer. Eddy current Dynamometer.Pressure measurement: gravitational type, High Pressure measurement-Bridgman Gauge. Low Pressure measurement-McLeod Gauge.	8 Hours
MODULE –V **Measurement of Flow and Temperature:** Introduction**,** Flow measurement: Venturi meter, Orifice meter, Rota meter, Pitot-tube. **Temperature measurement:** Liquid in glass thermometer, Bimetallic strip, pressurethermometer Thermocouples, Laws of thermocouples, measurement of emf. Pyrometry: Radiation pyrometer and optical pyrometer**.**	9 Hours

Textbooks:

1. I.C.Gupta-**EngineeringMetrology**,DhanpatRai Publications,7thedition, 2013.
2. RKJain,**EngineeringMetrology**,Khannapublications,8thedition,2002
3. Mechanical Measurements, Beckwith Marangoniand Lienhard, Pearson Education, 6thEd., 2006
4. AnandKBewoor,VinayAKulkarni,Metrology&Measurement,McGraw-Hill,2009

ReferenceBooks:

1. Engineering Metrology–K.J.Hume,MacdonaldandCo. Publisher, London
2. The Springer hand book of metrology and Testing, Czichos (Ed),2011
3. Engineering Metrology–D.M.Anthony, Pergamon Press
4. Engineering Metrology and Measurements, Bentley, Pearson Education
5. ASME, Hand book of Industrial Metrology,1998

At the end of the course students will be able to:

CO	Course Outcomes
CO1	Understand the objectives of metrology, methods of measurement and standards of measurement
CO2	An ability to get an exposure to linear measuring instruments and know the fundamentals of limits of size, fits, geometric and position tolerances, gauges and their design.
CO3	An ability to get knowledge of angular measuring instruments and understand the functioning of various comparators
CO4	Anabilitytogetanexposuretomeasuremajordiameter,minordiameter,pitch, angleandeffectivediameterofscrewthreadsby2-wire,3-wiremethodsand devices for measurement of gear, and applications of devices for measurement of force, torque, pressure.
CO5	Anabilitytogetanexposureaboutworkingprincipleandapplicationsofdevices for measurement off low and temperature

METROLOGY & INSTRUMENTATION LAB

Prerequisite: To have knowledge of measuring instruments used in physics and chemistry and fundamentals of Mathematics, Science, Manufacturing process and Electrical and Electronics.

Course Objectives:

1. The Metrology and instrumentation Laboratory course is designed for measuring and gauging instruments for inspection of precision linear, geometric forms, angular and surface finish measurements.
2. The student can learn the measurements with and calibration of instruments. They also understand the machine tool alignment test.
3. Instrumentation lab introduces the students with the theory and methods for conducting experimental work in the laboratory and calibration of various instruments for measuring pressure, temperature, displacement, speed, vibration etc.

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Modules

MODULE- I
METROLOGY ENGINEERING

1. Calibration of a micrometer using slip gauges
2. Measurements using optical projector / Tool maker's microscope.
3. Measurements of angle using sine center/sine bar/bevel protractor.
4. Measurements of alignment using auto collimator.
5. Measurements of cutting tool forces using a) lathe tool dynamometer
6. Measurements of cutting tool forces using a) drill tool dynamometer.
7. Measurements of screw thread parameters using two wire or three wire method.
8. Measurements of surface roughness using mechanical comparator /TalySurf.
9. Measurements of gear tooth profile using Vernier gear tooth calipers.
10. Measurements using optical flats.

Module –II
INSTRUMENTATION ENGINEERING.

1. Calibration of LVDT.
2. Calibration of load cell.
3. Calibration of thermocouple.
4. Calibration of pressure gauge.
5. Calibration of proving ring.
6. Determination of modulus of elasticity of a MS specimen using strain gauges.
7. Study of stroboscope and measurement of speed of shaft using stroboscope

At the end of the course students will be able to:	
CO	**Course Outcomes**
CO1	Abilityto handle different measurement tools and perform measurements
CO2	Performcalibration and analyze the characteristics of measuring instruments
CO3	Skillto use different gauges and determine the surface features and geometry of components
CO4	Todescribe and interpret measurement of variable like force, torque and pressure
CO5	Demonstrate the mechanical measurements and calibrations

MECHANICS OF MATERIALS			
Subject Code	22ME34	Credits: 03	CIE: 50
Number of Lecture Hours/Week	3 (Theory)		SEE: 50
Total Number of Lecture Hours	42		SEE Hours: 03

Prerequisites:

1. Students should necessarily have knowledge of Physics, Mechanics and good mathematical background.
2. Students should have the knowledge of mechanical properties of the engineering materials.

Course objectives:

1. To impart basic knowledge about the behavior of engineering materials under different load conditions.
2. To study the effect of different types of loads and their combinations on beams and columns and to compute the safe load carrying capacity and required dimensions.
3. To impart elementary knowledge about the design of shafts and springs.
4. To impart knowledge about the design of thin and thick cylinders subjected to internal and external fluid pressures.
5. To equip the students with the fundamental knowledge necessary for the design of machine elements in higher semesters.

Modules	Teaching Hours
MODULE - I **Introduction:** Mechanical properties of materials, Behavior of ductile and brittle materials under external loading, Types of loads and stresses, general assumptions made during the derivation of strength equations. Center of Gravity of plane figures and Moment of Inertia of I – Sections and T – Sections. **Simple Stresses & Strains:** Stress, Strain, Hooke's law, Poisson's ratio, Elastic constants and their inter relationship, Change in length of bars of circular and flat tapering cross sections.	**8 Hours**
MODULE II **Strain Energy & Impact Loading:** Resilience, Proof resilience, modulus of resilience,Expressions for strain energy stored in a body when the load applied is gradual, sudden and with an impact. **Principal Stresses & Strains:** Definition of principal planes and principal stresses, Methods for determining principal stresses on oblique section, Member subjected to direct stresses in two mutually perpendicular directions with or without shear stresses. (Numerical to be solved using equations, Derivations not included.), Graphical method not included.	**8 Hours**
MODULE III **Shear Force & Bending Moment:** Definition of Shear force, bending moment, Types of beams and loads, SFD and BMD of cantilever, simply supported beams with point load, UDL and their combinations (Maximum combination of three loads), Point of contra flexure. **Simple Bending and Shear Stresses in Beams:** Theory of simple bending, Neutral axis and moment of resistance, Section modulus of different cross sections such as square, rectangle, circular. Bending stress distribution. Shear stress at a section and its distribution for rectangular, circular, I and T- sections.	**10 Hours**

MODULE - IV **Torsion of Shafts:** Introduction, Torsion of circular (Hollow and solid) shafts, Torsion equation, Power transmitted by a shaft, Comparison between solid and hollow shafts, Strain energy in torsion. **Thin & Thick Cylinders:** Definition of thin and thick cylinders, Applications, Derivation of expressions of Hoop stress and longitudinal stresses, change in the dimensions of a thin cylindrical shell due to internal fluid pressure, Application of Lame's equations to thick	**8 Hours**
MODULE – V **Deflection of Beams**: Introduction, Methods of determining deflection of beams (Cantilever beams and simply supported beams subjected to a maximum of 3-point loads and UDL combinations). (Double integration method and Macaulay's method). **Columns & Struts:** Definitions, Different end conditions of the columns, Euler's theory of long columns (Derivation of Euler's Buckling load for different end conditions not included), Rankine's method, Analysis of solid and hollow columns with uniform circular cross section.	**8 Hours**

Question paper pattern:

1. Total of Ten Questions with two from each MODULE to be set covering the entire syllabus.
2. Five full questions are to be answered choosing at least one from each MODULE.
3. Each question should not have more than 4 sub divisions.

Text books:

1. Strength of Materials: R.K Bansal, Laxmi Publications, New Delhi.
2. Strength of Materials: S. Ramamrutham& R. Narayanan, Dhanpatrai Publishing Company, New Delhi.

Reference Books:

1. Mechanics of Materials: Egor P Popov, PHI, New Delhi.
2. Mechanics of Materials: J.M. Gere & Timoshenko, PWS publications, USA

E books and online course materials by NPTEL

Course outcomes: At the end of the course students will be able to:

CO	Course Outcome (COs)
CO1	Knowledge of different types of loads and stresses acting on engineering materials and their effect on the strength and properties of the same.
CO2	Skill to apply the basic formulae to find the stresses and select materials and the dimensions based on strength and properties.
CO3	An ability to represent graphically the distribution of shear forces and bending moments of beams under service loads.
CO4	Demonstrate the knowledge of understanding effect of torsions on shafts and also to find stresses in case of thin and thick cylinders so as to design for safe operating conditions.
CO5	Apply appropriate formulae and techniques to find critical load of columns and deflection of beams for safety of structures.

Note: CIE FOR 03 CREDIT PROFESSIONAL CORE COURSE

The CIE theory component constitutes of

- CIE IA Test with maximum 25 marks and minimum passing 10 marks
- CIE CCAs with maximum 25 marks and minimum passing 10 marks
- There shall be three Continuous Internal Evaluations (CIE) for the courses with 03credits.
- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.

The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.

The cumulative marks of the three CIE is to be divided by 3.6 to reduce the final CIE marks to a maximum of 25 marks and the minimum passing mark for this is 10.

Another 25 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests, etc, and the minimum passing mark for this is 10 (If the assessment is mini-project based then only one assessment method may be adopted or otherwise, any two assessment tools may be used.

SEMESTER END EXAMINATION (SEE):

Theory SEE will be conducted by scheduled timetable, with question papers for the subject (duration 03 hours).

The question paper shall be set for 100 marks.

- The duration of SEE is 03 hours. The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks.
- Students have to answer 5 full questions, selecting one full question from each module.
- The student has to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
- There will be 2 questions from each module. Each of the two questions under a module

MANUFACTURING PROCESSES-I Lab				
Subject Code	22MEL35	Credits	01	CIE: 50
Number of LectureHours/Week	2(Practical)			SEE: 50
Total Number of Lecture Hours	28			SEE Hours: 03

Prerequisite: Keenness to learn techniques used for metaljoining**.**

Course Objectives:

1. To get the first-hand information regarding Welding tools, safety precautions and process selection.
2. To be able to operate Gas Welding set up, understand flame settings and prepare variety of joints.
3. To understand the characteristics of AC arc welding equipment and prepare butt, lap joints.
4. To Study TIG and MIG welding set up and conduct experiments on it.
5. To understand the allied processes Soldering and Brazing and conduct joining experiments.

Modules

1. Functions and selection of tools used for welding processes, Brazing and Soldering.
2. To make BUTT Welding using the Gas welding Equipment.
3. To prepare a Lap Joint and Butt Joint using ARC Welding Process
4. To study the effect of AC current and Voltage on Weld bead and Heat affected Zone.(HAZ)
5. To prepare a joint on the given specimen using Spot welding equipment
6. To prepare a V-Butt joint using TIG-Welding.
7. To Prepare a Lap joint using TIG welding.
8. To prepare a V-Butt joint using MIG-Welding.
9. To join the given thin specimens using Soldering Process
10. To join two sheets using Brazing Process.

Question paper pattern:

Scheme of Examination: Students have to conduct 2 experiments.
Write up about experiments (in 30 mins): 15 Marks
Conducting experiments, Calculations, and Graphs: 25 Marks
Viva- Voice: 10 Marks
Total: 50 Marks

At the end of the course students will be able to:

CO	Course Outcomes
CO1	Select required tools for the given joining process.
CO2	Join the Mechanical Components using GAS and ARC Welding Processes.
CO3	Produce Joints using SPOT, TIG And MIG Welding Techniques.
CO4	Prepare Joints using Soldering Process.
CO5	Make Brazed Joints fortwo Metal Sheets.

CIE FOR THE COURSES WITH 01 CREDIT:

CIE FOR THE LABORATORY COURSE

- Maximum of 30 marks is allotted for Practical CIE (Continuous Internal Evaluation) for conduction of experiments and preparation of laboratory records etc with minimum passing marks 12.
- The test after all experiments conducted for 50 Marks needs to be reduced to 20 and the minimum passing mark is 08.
- Maximum of 50 marks is allotted for the practical SEE with minimum passing marks 20.

ENGINEERING SCIENCE COURSE

Electric and Hybrid Vehicle Technology				
Subject Code	22ME36A	Credits	03	CIE: 50
Number of LectureHours/Week	3			SEE: 50
Total Number of Lecture Hours	42	SEE Hours		03

Prerequisite :

Course Objectives:

Modules-I	Teaching Hours
Electric and Hybrid Electric Vehicles: Configuration of Electric Vehicles, Performance of Electric Vehicles, Traction motor characteristics, Tractive effort and Transmission requirement, Vehicle performance, Tractive effort in normal driving, Energy consumption Concept of Hybrid Electric Drive Trains, Architecture of Hybrid Electric Drive Trains, Series Hybrid Electric Drive Trains, Parallel hybrid electric drive trains.	**8 Hours**
Modules-II	
Energy storage for EV and HEV: Energy storage requirements, Battery parameters, Types of Batteries, Modelling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, PEMFC and its operation, Modelling of PEMFC, Supercapacitors.	**8 Hours**
Modules-III	
Electric Propulsion: EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives.	**8 Hours**
Modules-IV	
Design of Electric and Hybrid Electric Vehicles: Series Hybrid Electric Drive Train Design: Operating patterns, control strategies, Sizing of major components, power rating of traction motor, power rating of engine/generator, design of PPS Parallel Hybrid Electric Drive Train Design: Control strategies of parallel hybrid drive train, design of engine power capacity, design of electric motor drive capacity, transmission design, energy storage design.	**8 Hours**
Modules-V	
Power Electronic Converter for Battery Charging: Charging methods for battery, Termination methods, charging from grid, The Z-converter, Isolated bidirectional DC-DC converter, Design of Z- converter for battery charging, High-frequency transformer based isolated charger topology, Transformer less topology	**9Hours**

Textbooks:

1. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design M. Ehsani, Y. Gao, S. Gay and Ali Emadi CRC Press 2005
2. Electric and Hybrid Vehicles: Design Fundamentals Iqbal Husain CRC Press 2003

Reference Books: 1. Energy Management Strategies for Electric and Plug-in Hybrid Electric Vehicles Sheldon S. Williamson Springer 2013 2. Modern Electric Vehicle Technology C.C. Chan and K.T. Chau Oxford University 2001	
Course Outcomes:	
CO1	Explain the working of electric vehicles and recent trends.
CO2	Analyze different power converter topology used for electric vehicle application.
CO3	Develop the electric propulsion unit and its control for application of electric vehicles.
CO4	Design converters for battery charging and explain transformer less topology.
CO5	Know the Charging methods for battery

Note: CIE FOR 03 CREDIT PROFESSIONAL CORE COURSE

The CIE theory component constitutes of

- CIE IA Test with maximum 25 marks and minimum passing 10 marks
- CIE CCAs with maximum 25 marks and minimum passing 10 marks
- There shall be three Continuous Internal Evaluations (CIE) for the courses with 03 credits.
- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.

The question needs to be framed covering the entire syllabus (33%) completed before the consecutiveCIEs.

The cumulative marks of the three CIE are to be divided by 3.6 to reduce the final CIE marks to a maximum of 25 marks and the minimum passing mark for this is 10.

Another 25 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests, etc. and the minimum passing mark for this is 10 (If the assessment is mini-project based then only one assessment method may be adopted or otherwise, any two assessment tools may be used.

SEMESTER END EXAMINATION (SEE):

Theory SEE will be conducted by scheduled timetable, with question papers for the subject (duration 03 hours).
The question paper shall be set for 100 marks.

- The duration of SEE is 03 hours. The question paper will have 10 questions. Two questions permodule. Each question is set for 20 marks.
- Students have to answer 5 full questions, selecting one full question from each module.
- The student has to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
- There will be 2 questions from each module. Each of the two questions under a module.

Smart Materials and Systems				
Subject Code	22ME36B	Credits	03	CIE: 50
Number of LectureHours/Week	3			SEE: 50
Total Number of Lecture Hours	42	SEE Hours:		03

Prerequisite :

Course Objectives:

- To develop the students ability to learn emerging materials.
- To make students to learn prefabricated building components
- To understand the sensors deployed in smart buildings
- To learn building information modeling for building design
- To learn the concepts of 3-D printing

Modules-I	Teaching Hours
Emerging Materials : Honey comb structure (Carbon composites), Nano-materials, engineered polymers, emerging sustainable by products (Fly ash and GGBS) and construction chemicals.	**8 Hours**
Modules-II	
Prefabricated/ Manufactured building components: Definition, types of prefabricated/ manufactured building components and infrastructure, modular coordination, standardization, materials, systems, production, transportation and installation.	**8 Hours**
Modules-III	
Smart Materials: Definition, Principles of Piezo-electricity, materials (Polymers and Ceramics), sensors (Piezo-electric sensor, strain gauge, shear sensor, in-plane and out of plane sensor, accelerometer), smart composites	**9Hours**
Modules-IV	
BIM and IBMS BIM: Definition, Necessity, advantages, BIM in building design, infrastructure design and construction IBMS – Definition, Necessity, advantages, Types of IBMS.	**8 Hours**
Modules-V	
3-D Printing: Importance, Historic development, advantages, common terminologies, classification, Process chain, 3 – D modeling, Data conversion and transmission, checking and preparation, Building, Post processing, Applications	**9Hours**

Textbooks:

1 Donald R. Askeland and Pradeep P. Fulay, Essentials of Materials Science and Engineering, 2009, Cengage Learning.

Course Outcomes:

CO1	Make use emerging materials for construction
CO2	Decide the proper prefabricated building component
CO3	Use smart materials and methods in building construction
CO4	Implement BIM in building design
CO5	Prepare 3-D modelling and manufacture building component

Note: CIE FOR 03 CREDIT PROFESSIONAL CORE COURSE

The CIE theory component constitutes of

- CIE IA Test with maximum 25 marks and minimum passing 10 marks
- CIE CCAs with maximum 25 marks and minimum passing 10 marks
- There shall be three Continuous Internal Evaluations (CIE) for the courses with 03 credits.
- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.

The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.

The cumulative marks of the three CIE is to be divided by 3.6 to reduce the final CIE marks to a maximum of 25 marks and the minimum passing mark for this is 10.

Another 25 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests, etc, and the minimum passing mark for this is 10 (If the assessment is mini-project based then only one assessment method may be adopted or otherwise, any two assessment tools may be used.

SEMESTER END EXAMINATION (SEE):

Theory SEE will be conducted by scheduled timetable, with question papers for the subject (duration 03 hours).

- The question paper shall be set for 100 marks.
- The duration of SEE is 03 hours. The question paper will have 10 questions. Two questions permodule. Each question is set for 20 marks.
- Students have to answer 5 full questions, selecting one full question from each module.
- The student has to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
- There will be 2 questions from each module. Each of the two questions under a module.

Introduction to Internet of Things (IoT)				
Subject Code	22ME36C	Credits	03	CIE: 50
Number of LectureHours/Week	3			SEE: 50
Total Number of Lecture Hours	42		SEE Hours:	03
Prerequisite :				
Course Objectives: 1. Understand about the fundamentals of Internet of Things and its building blocksalong with their characteristics. 2. Understand the recent application domains of IoT in everyday life. **3.** Gain insights about the current trends of Associated IOT technologies and IOT Analytics.				
Modules-I				**Teaching Hours**
Basics of Networking: Introduction, Network Types, Layered network models **Emergence of IoT:** Introduction, Evolution of IoT, Enabling IoT and the Complex Interdependence of Technologies, IoT Networking Components				**8 Hours**
Modules-II				
IoT Sensing and Actuation: Introduction, Sensors, Sensor Characteristics, Sensorial Deviations, Sensing Types, Sensing Considerations, Actuators, Actuator Types, Actuator Characteristics.				**8 Hours**
Modules-III				
IoT Processing Topologies and Types: Data Format, Importance of Processing in IoT, Processing Topologies, IoT Device Design and Selection Considerations, Processing Offloading.				**8 Hours**
Modules-IV				
Associated Iot Technologies Cloud Computing: Introduction, Virtualization, Cloud Models, Service-Level Agreement in Cloud Computing, Cloud Implementation, Sensor-Cloud: Sensors-as-a-Service. **Iot Case Studies:**Agricultural IoT – Introduction and Case Studies				**9 Hours**
Modules-V				
Iot Case Studies And Future Trends: Vehicular IoT – Introduction Healthcare IoT – Introduction, Case Studies IoT Analytics – Introduction				**9 Hours**
Textbooks: 1. Sudip Misra, Anandarup Mukherjee, Arijit Roy, "Introduction to IoT", Cambridge University Press 2021. Reference: 2. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press. 3. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014. 4. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013.				

Course Outcomes:	
CO1	Describe the evolution of IoT, IoT networking components, and addressing strategies in IoT.
CO2	Classify various sensing devices and actuator types.
CO3	Demonstrate the processing in IoT.
CO4	Explain Associated IOT Technologoes
CO5	Illustrate architecture of IOT Applications

Note: CIE FOR 03 CREDIT PROFESSIONAL CORE COURSE

The CIE theory component constitutes of

- CIE IA Test with maximum 25 marks and minimum passing 10 marks
- CIE CCAs with maximum 25 marks and minimum passing 10 marks
- There shall be three Continuous Internal Evaluations (CIE) for the courses with 03 credits.
- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.

The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.

The cumulative marks of the three CIE is to be divided by 3.6 to reduce the final CIE marks to a maximum of 25 marks and the minimum passing mark for this is 10.

Another 25 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests, etc, and the minimum passing mark for this is 10 (If the assessment is mini-project based then only one assessment method may be adopted or otherwise, any two assessment tools may be used.

SEMESTER END EXAMINATION (SEE):

Theory SEE will be conducted by scheduled timetable, with question papers for the subject (duration 03 hours).
The question paper shall be set for 100 marks.

- The duration of SEE is 03 hours. The question paper will have 10 questions. Two questions permodule. Each question is set for 20 marks.
- Students have to answer 5 full questions, selecting one full question from each module.
- The student has to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
- There will be 2 questions from each module. Each of the two questions under a module.

Waste Management				
Subject Code	22ME36D	Credits	03	CIE: 50
Number of LectureHours/Week	3			SEE: 50
Total Number of Lecture Hours	42		SEE Hours:	03
Prerequisite:				
Course Objectives: • To learn broader understandings on various aspects of solid waste management practiced in industries. • To learn recovery of products from solid waste to compost and biogas, incineration and energy recovery, hazardous waste management and treatment, and integrated waste management.				
Modules-I				**Teaching Hours**
INTRODUCTION TO SOLID WASTE MANAGEMENT: Classification of solid wastes (source and type based), solid waste management (SWM), elements of SWM, ESSWM (environmentally sound solid waste management) and EST (environmentally sound technologies), factors affecting SWM, Indian scenario, progress in MSW (municipal solid waste) management in India. Indian and global scenario of e-waste,				**8 Hours**
Modules-II				
WASTE GENERATION ASPECTS: Waste stream assessment (WSA), waste generation and composition, waste characteristics (physical and chemical), health and environmental effects (public health and environmental), comparative assessment of waste generation and composition of developing and developed nations, a case study results from an Indian city, handouts on solid waste compositions. E-waste generation.				**8 Hours**
Modules-III				
COLLECTION, STORAGE, TRANSPORT AND DISPOSAL OF WASTES: Waste Collection, Storage and Transport: Collection components, storage-containers/collection vehicles, collection operation, transfer station, waste collection system design, record keeping, control, inventory and monitoring, implementing collection and transfer system, a case study. Waste Disposal: key issues in waste disposal, disposal options and selection criteria, sanitary landfill, landfill gas emission, leachate formation, environmental effects of landfill, landfill operation issues, a case study.				**9Hours**
Modules-IV				
WASTE PROCESSING TECHNIQUES & SOURCE REDUCTION, PRODUCT RECOVERY & RECYCLING: Purpose of processing, mechanical volume and size reduction, component separation, drying and dewatering. Source Reduction, Product Recovery and Recycling: basics, purpose, implementation monitoring and evaluation of source reduction, significance of recycling, planning of a recycling programme, recycling programme elements, commonly recycled materials and processes, a case study.				**9Hours**
Modules-V				
HAZARDOUS WASTE MANAGEMENT AND TREATMENT: Identification and classification of hazardous waste, hazardous waste treatment, pollution prevention and waste minimization, hazardous wastes management in India. E-waste recycling.				**8Hours**

Textbooks:

1. Tchobaanoglous, G., Theisen, H., and Samuel A Vigil, Integrated Solid Waste Management, McGraw-Hill Publishers, 1993.
2. Bilitewski B., Hard He G., Marek K., Weissbach A., and Boeddicker H., Waste Management, Springer, 1994.

Reference Books:

1. White, F. R., Franke P. R.,,&Hindle M., Integrated solid waste management: a life cycle inventory. McDougall,P. John Wiley & Sons. 2001
2. Nicholas, P., & Cheremisinoff, P. D., Handbook of solid waste management and waste minimization technologies, Imprint of Elsevier Science. 2005

Course Outcomes:

CO1	Apply the basics of solid waste management towards sustainable development
CO2	Apply technologies to process waste and dispose the same.
CO3	Design working models to convert waste to energy
CO4	Identify and apply waste processing techniques
CO5	Identify and classify hazardous waste and manage the hazard

Note: CIE FOR 03 CREDIT PROFESSIONAL CORE COURSE

The CIE theory component constitutes of

- CIE IA Test with maximum 25 marks and minimum passing 10 marks
- CIE CCAs with maximum 25 marks and minimum passing 10 marks
- There shall be three Continuous Internal Evaluations (CIE) for the courses with 03 credits.
- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.

The question needs to be framed covering the entire syllabus (33%) completed before the consecutiveCIEs.

The cumulative marks of the three CIE is to be divided by 3.6 to reduce the final CIE marks to a maximum of 25 marks and the minimum passing mark for this is 10.

Another 25 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests, etc. and the minimum passing mark for this is 10 (If the assessment is mini-project based then only one assessment method may be adopted or otherwise, any two assessment tools may be used.

SEMESTER END EXAMINATION (SEE):

Theory SEE will be conducted by scheduled timetable, with question papers for the subject (duration 03 hours).
The question paper shall be set for 100 marks.

- The duration of SEE is 03 hours. The question paper will have 10 questions. Two questions permodule. Each question is set for 20 marks.
- Students have to answer 5 full questions, selecting one full question from each module.
- The student has to answer for 100 marks and marks scored out of 100 shall be proportionally reducedto 50 marks.
- There will be 2 questions from each module. Each of the two questions under a module.

SOCIAL CONNECT AND RESPONSIBILITY

[As per Choice Based Credit System (CBCS) Scheme]
(From the academic year 2022-23)

Course Code	22UHV37	CIE Marks	50
Credits	01	SEE Marks	50
Course Type	Practical		
Lecture Hours/Week (L-T-P)	0-0-2	Total Marks	100
Total Hours	28 Hours	SEE Hours	2 Hrs.

Course Objectives:

- To familiarize the students with the basic biological concepts and their engineering applications.
- To enable the students with an understanding of biodesign principles to create novel devices and structures.
- To provide the students an appreciation of how biological systems can be re-designed as substitute products for natural systems.
- To motivate the students to develop interdisciplinary vision of biological engineering.

Teaching-Learning Process(General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning /inquiry-based teaching.
2. Instructions with interactions in classroom lectures (physical/hybrid).
3. Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
4. Flipped classroom sessions (~10% of the classes).
5. Industrial visits, Guests talks and competitions for learning beyond the syllabus.
6. Students' participation through audio-video based content creation for the syllabus (as assignments).
7. Use of gamification tools (in both physical/hybrid classes) for creative learning outcomes.
8. Students' seminars (in solo or group) /oral presentations

Modules	Hours
Module - I **Plantation and adoption of a tree:** Plantation of a tree that will be adopted for four years by a group of BE / B.Tech students. (ONE STUDENT ONE TREE) They will also make an excerpt either as a documentary or a photo blog describing the plant's origin, its usage in daily life, its appearance in folklore and literature - – Objectives, Visit, case study, report, outcomes.	06 Hours

Modules	Hours
Module - II **Heritage walk and crafts corner:** Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photo blog and documentary on evolution and practice of various craft forms - – Objectives,Visit, case study, report, outcomes.	06 Hours
Module - III **Organic farming and waste management:** Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus Objectives,Visit, case study, report, outcomes.	06 Hours
Module - IV **Water conservation:** Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photoblog presenting the current practices – Objectives, Visit, case study, report, outcomes.	05 Hours
Module - V **Food walk:** City's culinary practices, food lore, and indigenous materials of the region used in cooking – Objectives, Visit, case study, report, outcomes.	05 Hours

Course outcomes (Course Skill Set):

At the end of the course, the student will be able to:

CO1: Communicate and connect to the surrounding. CO2: Create a responsible connection with the society.

CO3: Involve in the community in general in which they work.

CO4: Notice the needs and problems of the community and involve them in problem –solving.

CO5: Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.

CO6: Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.

Activities:

Jamming session, open mic, and poetry: Platform to connect to others. Share the stories with others. Share the experience of Social Connect. Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

PEDAGOGY:

The pedagogy will include interactive lectures, inspiring guest talks, field visits, social immersion, and a course project. Applying and synthesizing information from these sources to define the social problem to address and take up the solution as the course project, with your group. Social immersionwith NGOs/social sections will be a key part of the course. Will all lead to the course project that will address the needs of the social sector?

COURSE TOPICS:

The course will introduce social context and various players in the social space, and present approaches to discovering and understanding social needs. Social immersion and inspiring conversional will culminate in developing an actual, idea for problem-based intervention, based on an in-depth understanding of a key social problem.

Duration :

A total of 40 - 50 hrs engagement per semester is required for the 3rd semester of the B.E. /B.Tech. program. The students will be divided into groups. Each group will be handled by faculty mentor. Faculty mentor will design the activities (particularly Jamming sessions open mic ,and poetry) Faculty mentors has to design the evaluation system as per VTU guidelines of scheme & syllabus.

Guideline for Assessment Process:

Continuous Internal Evaluation (CIE):

After completion of the course, the student shall prepare, with daily diary as reference, a comprehensive report in consultation with the mentor/s to indicate what he has observed and learned in the social connect period. The report should be signed by the mentor. The report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed. Marks allotted for the diary are out of 50. Planning and scheduling the social connect Information/Data collected during the social connect Analysis of the information/data and report writing Considering all above points allotting the marks as mentioned below

Excellent: 80 to 100

Good: 60 to 79

Satisfactory: 40 to 59

Unsatisfactory and fail : <39

Pedagogy – Guidelines:

It may differ depending on local resources available for the study as well as environment and climatic differences, location and time of execution.

Sl No	Topic	Group size	Location	Activity execution	Reporting	Evaluation Of the Topic
1.	**Plantation and adoption of a tree:**	May be individual or team	Farmers land/ parks / Villages / roadside/ community area / College campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
2.	**Heritage walk and crafts corner:**	May be individual or team	Temples / monumental places / Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Site selection /proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
3.	**Organic farming and waste management:**	May be individual or team	Farmers land / parks / Villages visits / roadside/ community area / College campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
4.	**Water conservation:** & conservation techniques	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers / campus etc…..	site selection / proper consultation/Continuous monitoring/ Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty
5.	**Food walk: Practices in society**	May be individual or team	Villages/ City Areas / Grama panchayat/ public associations/Government Schemes officers/ campus etc…..	Group selection / proper consultation / Continuous monitoring / Information board	Report should be submitted by individual to the concerned evaluation authority	Evaluation as per the rubrics Of scheme and syllabus by Faculty

Plan of Action (Execution of Activities)

Sl.NO	Practice Session Description
1	**Lecture session in field to start activities**
2	**Students Presentation on Ideas**
3	**Commencement of activity and its progress**
4	**Execution of Activity**
5	**Execution of Activity**
6	**Execution of Activity**
7	**Execution of Activity**
8	**Case study based Assessment, Individual performance**
9	**Sector/ Team wise study and its consolidation**
10	**Video based seminar for 10 minutes by each student At the end of semester with Report.**

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1st to 5th, compiled report should be submitted as per the instructions and scheme.

Assessment Details for CIE (both CIE and SEE)

Weightage	**CIE – 100%**	• Implementation strategies of the project (NSS work). • The last report should be signed by NSS Officer, the HOD and principal. • At last report should be evaluated by the NSS officer of the institute. • Finally the consolidated marks sheet should be sent to the university and also to be made available at LIC visit.
Field Visit, Plan, Discussion	10 Marks	
Commencement of activities and its progress	20 Marks	
Case study based Assessment Individual performance with report	20 Marks	
Sector wise study & its consolidation 5*5 = 25	25 Marks	
Video based seminar for 10 minutes by each student At the end of semester with Report. **Activities 1 to 5, 5*5 = 25**	25 Marks	
Total marks for the course in each semester	**100 Marks**	

For each activity, 20 marks CIE will be evaluated for IA marks at the end of semester, Report and assessment copy should be made available in the department.

Students should present the progress of the activities as per the schedule in the prescribed practical session in the field. There should be positive progress in the vertical order for the benefit of society in general through activities.

Ability Enhancement Course/Skill Enhancement Course-III

RAPID PROTOTYPING			
Subject Code	**22MEAE381**	**Credits:01**	**CIE: 50**
Number of Lecture Hours/Week	**2 (Practical)**		**SEE:50**
Total Number of Lecture Hours	**28**		**SEEHours:03**

PREREQUISITE:NIL

COURSEOBJECTIVES:

1. To optimize the process parameters of FDM machine to improve the quality of the parts produced.
2. To build complex engineering assemblies in plastic material with less process planning.
3. To improve surface finish of fabricated plastic components for the engineering applications.
4. To design and fabricate working models for the conceptual testing applications.

DETAILED SYLLABUS

1. Review of CAD Modeling Techniques and Introduction to RP
2. Forming Groups & Assigning Creative Idea
3. Modeling Creative Design in CAD Software
4. Assembling Creative Designs in CAD Software
5. Generating STL files from the CAD Models & Working on STL files
6. Processing the CAD data in3D Printing software(Selection of Orientation, supports generation, Slicing, Tool path generation)
7. Sending the tool path data to FDMRP machine
8. Fabricating the physical part on FDMRP machine
9. Removing the supports & post processing (cleaning the surfaces)
10. Demonstrating Creative Working Models

TEXT BOOK: Chua Chee Kai., Leong Kah Fai., Chu Sing Lim, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific, 2010.

REFERENCES:

1. FDM Dimension 768 RP Machine Manual, Stratasys INC., USA, 2006.
2. Mojor 3D Printer Manual, Stratasys INC., USA, 2013.

Course outcomes:
On completion ofthecourse,thestudentwillhavetheabilityto:

CO#	CourseOutcome(CO)
CO1	OptimizetheprocessparametersofFDMmachinetoimprovethequalityofthe partsproduced.
CO2	Buildcomplexengineeringassembliesinplasticmaterialwithlessprocessplanning.
CO3	Improvesurfacefinishoffabricatedplasticcomponentsfortheengineeringapplications.
CO4	Designandfabricateworkingmodelsfortheconceptualtestingapplications.
CO5	Demonstrating Creative Working Models

CIE FOR THE LABORATORY COURSE

Maximum of 30 marks is allotted for Practical CIE (Continuous Internal Evaluation) for conduction of experiments and preparation of laboratory records etc. with minimum passing marks 12.

- The test after all experiments conducted for 50 Marks needs to be reduced to 20 and the minimum passing mark is 08.
- Maximum of 50 marks is allotted for the practical SEE with minimum passing marks 20.

INTRODUCTION TO HUMAN FACTORS AND ERGONOMICS			
SubjectCode	**22MEAE382**	**Credits:01**	**CIE: 50**
NumberofLecture Hours/Week	**2 (Tutorial)**		**SEE:50**
TotalNumberofLecture Hours	**28**		**SEEHours:02**

PREREQUISITE:NIL

COURSEOBJECTIVES:
To teach the methods for productivity measurements and improvements, work study methods, ergonomic, methods for workplace design.

Module-I	**Total Hours**
Introduction, productivity, productivity and production, productivity measurement, means of increasing productivity, improving the productivity by reducing work content. Introduction to work study, Method study, objectives of method study, basic procedure in method study movements of workers and materials, string diagram, worker type flow process chart, multiple activity chart, travel chart.	**6Hours**
Module-II	
Definition of work measurement, purpose and uses of work measurement, basic procedure, techniques of work measurement. Definition of time study, time study equipment and forms, stop watch procedure.	**4Hours**
Module-III	
Definition of Rating, the qualified and average worker, factors affecting the rate of working, scales of rating, how the rating factors is used, recording the rating. Calculation of basic time, selected time, Allowances, calculation of allowances, relaxation allowances, other allowances, standard time. Principles of motion economy and application: -Evaluate, define, install, and maintain the method, Importance of method study in the office. Purpose and application of micro motion study, therbligs, equipments, cycle graph and chronocyclegraph.	**6Hours**
Module-IV	
Introduction to Ergonomics, consequences of not using ergonomics, areas of study covered under ergonomics, work capabilities of industrial worker, Work design consideration, functions performed by Man & Mechanism involved, general principles for carrying out physical activities, development of stress in human body & their consequences.	**6Hours**
Module-V	
Man-Machine system:- Design of work place-Machine at work place-Working at work place-Seat for work place, Influence of Climate, Noise & vibration and Lighting systems on the efficiency of human performance.	**6Hours**

TEXT BOOK:1.Bridger R S, Introduction to Ergonomics, Taylor and Francis, 2008.

REFERENCES:

1. Aft, Work Measurement and Methods, Wiley John and Sons, 2000 28
2. Barnes, Raeph.M., "Motion and Time Study – Design and Measurement of Work ", John Wiley & sons, New York, 1990
3. Mc.Cormick, E.J., "Human Factors in Engineering and Design", McGraw Hill
4. ILO, "Introduction to Work study", Geneva, 1974.
5. Applied Ergonomics Hand Book - Brien Shakel (Edited) - Butterworth Scientific, London – 1988.

CourseOutcomes: On completion ofthecourse,thestudentwillhavetheabilityto:	
CO#	**CourseOutcome(CO)**
CO1	Illustrate the fundamentals of productivity and analyze Work study.
CO2	Distinguish between time study and method study.
CO3	Compare the observed rate of working with the standard by calculating a standard time.
CO4	Analyze the ergonomic methods for workplace design.
CO5	Perform ergonomic analysis to provide comfortable work environment with a view to maximize the performance of men/machines.

CIE FOR THE COURSES WITH 01 CREDIT

a)CIE THEORY COMPONENT

The CIE theory component constitutes ofCIE IA Test with maximum 25 marks and minimum passing 10 marks

CIE CCAs with maximum 25 marks and minimum passing 10 marks

- There shall be three Continuous Internal Evaluations (CIE) for 1. Credit course
- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.
- The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.
- The cumulative marks of the three CIE are to be divided by 3.6 to reduce the final CIE marks to a maximum of 25 marks and the minimum passing mark for this is 10.
- Another 25 marks are dedicated to other assessment tools with suitable weightage for eachthat include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests etc, and minimum passing marks for this is 10. (Any two assessment tools may be used. The assessment tools must be discussed and got approved by the concerned HoD before the commencement of the course)

b) SEMESTER END EXAMINATIONS:

- The SEE theory exam to be conducted for 50 marks with minimum passing marks 18.
- The SEE question paper with Multiple Choice Question (MCQs) type is set for 50 questions each of the 01 marks.

SPREAD SHEETS FOR ENGINEERS			
Subject Code	22MEAE383	Credits: 01	CIE: 50
Number of Lecture Hours/Week	02 LAB		SEE: 50
Total Number of Lecture Hours	28		SEE Hours: 03

Course objectives:

1. To create different plots and charts
2. To compute different functions, conditional functions and make regression analysis
3. To carryout iterative solutions for roots, multiple roots, optimization and non-linear regression analysis
4. To carryout matrix operations
5. To Understand VBA and UDF
6. To understand VBA subroutines and Macros
7. To carryout numerical integration and solving differential equations using different methods

S No	Experiments
01	**Charting:** Create an XY scatter graph, XY chart with two Y-Axes, add error bars to your plot, create a combination chart
02	**Functions:** Computing Sum, Average, Count, Max and Min, Computing Weighted Average, Trigonometric Functions, Exponential Functions, Using the CONVERT Function to Convert Units
03	**Conditional Functions:** Logical Expressions, Boolean Functions, IF Function, Creating a Quadratic Equation Solver, Table VLOOKUP Function, AND, OR and XOR functions.
04	**Regression Analysis:** Trendline, Slope and Intercept, Interpolation and Forecast, The LINEST Function, Multilinear Regression, Polynomial Fit Functions, Residuals Plot, Slope and Tangent, Analysis Tool Pack.
05	**Iterative Solutions Using Excel:** Using Goal Seek in Excel, Using the Solver to Find Roots, Finding Multiple Roots, Optimization Using the Solver, Minimization Analysis, Nonlinear Regression Analysis.
06	**Matrix Operations Using Excel:** Adding Two Matrices, multiplying a Matrix by a Scalar, Multiplying Two Matrices, transposing a Matrix, inverting a Matrix and Solving System of Linear Equations.
07	**VBA User-Defined Functions (UDF):** The Visual Basic Editor (VBE), The IF Structure, The Select Case Structure, The for Next Structure, The Do Loop Structure, Declaring Variables and Data Types, An Array Function the Excel Object Model, For Each Next Structure.
08	**VBA Subroutines or Macros**: Recording a Macro, coding a Macro Finding Roots by Bisection, Using Arrays, adding a Control and Creating User Forms.
	Demonstration Exercises
09	**Numerical Integration Using Excel:** The Rectangle Rule, The Trapezoid Rule, The Simpson's Rule, creating a User-Defined Function Using the Simpson's Rule.
10	**Differential Equations:** Euler's Method, Modified Euler's Method, The Runge Kutta Method, Solving a Second 12 Order Differential Equation
	Course outcomes (Course Skill Set): At the end of the course the student will be able to: • To create different plots and charts • To compute different functions, conditional functions and make regression analysis • To carryout iterative solutions for roots, multiple roots, optimization and non-linear regression analysis • To carryout matrix operations • To Understand VBA and UDF • To understand VBA subroutines and Macros • To carryout numerical integration and solving differential equations using different methods

Suggested Learning Resources:
McFedries Paul Microsoft Excel 2019 Formulas and Functions Microsoft Press, U.S, 2019 Edition

CIE FOR THE LABORATORY COURSE

- Maximum of 30 marks is allotted for Practical CIE (Continuous Internal Evaluation) for conduction of experiments and preparation of laboratory records etc. with minimum passing marks 12.
- The test after all experiments conducted for 50 Marks needs to be reduced to 20 and the minimum passing mark is 08.
- Maximum of 50 marks is allotted for the practical SEE with minimum passing marks 20.

ANALYTICAL SKILLS			
SubjectCode	22MEAE384	**Credits: 01**	**CIE: 50**
NumberofLecture Hours/Week	**2**		**SEE:50**
TotalNumberofLecture Hours	**28**		**SEEHours:03**

PREREQUISITE:NIL

COURSEOBJECTIVES:

Intended to inculcate quantitative analytical skills and reasoning as an inherent ability in students.

Module-I	**Teaching Hours**
Arithmetic ability: Algebraic operations BODMAS, Fractions, Divisibility rules, LCM & GCD(HCF).	**6Hours**
Module-II **Verbal Reasoning:** Number Series, Coding & Decoding, Blood relationship, Clocks, Calendars.	**6Hours**
Module-III **Quantitative aptitude:** Averages, Ratio and proportion, Problems on ages, Time-distance–speed.	**5Hours**
Module-IV **Business computations:** Percentages, Profit & loss, Partnership, simple compound interest.	**6Hours**
Module-V **Data Interpretation:** Tabulation, Bar Graphs, Pie Charts, line Graphs. Venn diagrams.	**5Hours**

Recommended Co-Curricular Activities:
Surprise tests / Viva-Voice / Problem solving/Group discussion.

TextBook:
QuantitativeAptitudefor Competitive ExaminationbyR.S. Agrawal,S.ChandPublications.

ReferenceBooks:
1. AnalyticalskillsbyShowickThorpe,publishedbySChandAndCompanyLimited,Ramnagar,NewDelhi-110055.
2. QuantitativeAptitude andReasoningbyR V Praveen,PHIpublishers.
3. QuantitativeAptitudeforCompetitiveExaminationbyAbhijitGuha,TataMcGrawHillPublications.

Courseoutcomes:
On completion ofthecourse,thestudentwillhavetheabilityto:

CO#	CourseOutcome(CO)
CO1	Understand the basic concepts of arithmetic ability, quantitative ability, logical reasoning, business computations and data interpretation and obtain the associated skills.
CO2	Acquirecompetencyin theuse of verbal reasoning
CO3	Applythe skillsand competenciesacquired intherelatedareas
CO4	Solveproblemspertainingtoquantitative ability,logicalreasoningandverbalabilityinsideand outside thecampus.

CIE FOR THE COURSES WITH 01 CREDIT

a)CIE THEORY COMPONENT

The CIE theory component constitutes of

- CIE IA Test with maximum 25 marks and minimum passing 10 marks
- CIE CCAs with maximum 25 marks and minimum passing 10 marks

- There shall be three Continuous Internal Evaluations (CIE) for 1. Credit course

- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.
- The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.
- The cumulative marks of the three CIE is to be divided by 3.6 to reduce the final CIE marks to a maximum of 25 marks and the minimum passing mark for this is 10.

- Another 25 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests etc, and minimum passing marks for this is 10. (Any two assessment tools may be used. The assessment tools must be discussed and got approved by the concerned HoD before the commencement of the course)

b) SEMESTER END EXAMINATIONS:

- The SEE theory exam to be conducted for 50 marks with minimum passing marks 18.
- The SEE question paper with Multiple Choice Question (MCQs) type is set for 50 questions each of the 01 marks.

NATIONAL SERVICE SCHEME (NSS)

[As per Choice Based Credit System (CBCS) Scheme]
(From the academic year 2022-23)

Course Code	22NS39	CIE Marks	50
Credits	00	SEE Marks	00
Course Type	Practical		
Lecture Hours/Week (L-T-P)	0-0-2	Total Marks	50
Total Hours	28 Hours	SEE Hours	--

Pre-requisites to take this Course:

1. Students should have a service oriented mind set and social concern.
2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.

Students should be ready to sacrifice some of the time and wishes to achieve service oriented targets on time.

Corse Objectives :National Service Scheme (NSS) will enable the students to:

1. Understand the community in which they work
2. Identify the needs and problems of the community and involve them in problem-solving
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath,Make in India, Mudra scheme, Skill development programs etc.
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.

12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

ONENSS – CAMP @ College /University /Stateor Central GovtLevel /NGO's /General Social Camps

Students have to take up anyone activity on the above said topics and have to prepare content for awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same. Compulsorily students have to attend one camp.
CIE will be evaluated based on their presentation, approach and implementation strategies.

Course Outcomes:

After completing the course, the students will be able to

CO1: Under stand the importance of his / her responsibilities towards society.
CO2: Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4: Implement government or self-driven projects effectively in the field.

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	SEE
Presentation 1-Selectionoftopic-(phase 1)	**10**	*****
EXPERIENTIAL LEARNING Presentation 2(phase2)	**10**	*****
Case Study-based Teaching-Learning	**10**	• Implementation strategies of the project with report duly signed by the Dept's Coordinator, HoD & Principal. • At last It should be evaluated by the NSS Coordinator. • Finally consolidated report should be sent to the University.
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKSFORTHE COURSE	**50 MARKS**	**50 MARKS**

Suggested Learning Resource:

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.

PHYSICAL EDUCATION AND SPORTS

[As per Choice Based Credit System (CBCS) Scheme]
(From the academic year 2022-23)

Course Code	22PE39	CIE Marks	50
Credits	00	SEE Marks	00
Course Type	Practical		
Lecture Hours/Week (L-T-P)	0-0-2	Total Marks	50
Total Hours	28 Hours	SEE Hours	--

SEMESTER	COURSE
III	**Fitness Components** Kabaddi/ Kho Kho
IV	**Athletics** Volleyball Throw ball / Chess
V	**Athletics** Football/Hockey
VI	**Athletics** Cricket/Base ball
VII	**Athletics** Netball/Basketball
VIII	**Individual Games** Handball/ Badminton

Notes:

- One Hour of Lecture is equal to 1 Credit
- One Hour of Tutorial is equal to 1 Credit (Except Languages)
- Two Hours of Practical is equal to 1 Credit
- SEE : Semester End Examination
- CIE : Continuous Internal Examination
- L+T+P : Lecture + Tutorial + Practical

Semester	Course Title	Content	No. Hours
III	**Fitness** **Component** Speed Strength Endurance Agility Flexibility	Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. ***Practical Components: Speed, Strength, Endurance, Flexibility, and Agility*** **KABADDI** **A. Fundamental skills** 1. Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line. 2. Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques. 2-3-2 System Chain Formation 3. Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense. 4. Game practice with application of Rules and Regulations. **B. Rules and their interpretations and duties of the officials.**	Total 32 Hrs 2 Hrs/Week
	Kho kho	**A. Fundamental skills** 1. Skills in Chasing: Sit on the box (Parallel & Bullet method), Get up from the box (Proximal & Distal method), Give Kho (Simple, Early, Late &Judgment), Pole Dive, Tapping, Hammering, Rectification of foul. 2.Skills in running: Chain Play, Ring play and Double and Single chain & Ring mixed play figure of 8-3 by 6. 3.Game practice with application of Rules and Regulations. **B. Rules and their interpretations and duties of the officials.**	

Semester	Course Title	Content	No. Hours
IV	**Athletics Track-** Sprints **Jumps-** Long Jump **Throws-** Shot Put	**Track Events** 1.1. Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. 1.2. Minimum Optimum and Maximum, Acceleration with proper running techniques. 1.3. Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. **Long Jump**: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick) and Landing **Shot put:** Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique	Total 32 Hrs 2 Hrs/Week
	Volley Ball	**A. Fundamental skills** 1. Service: Under arm service, Side arm service, Tennis service, Floating service. 2. Pass: Under arm pass, Over head pass. 3. Spiking and Blocking. 4. Game practice with application of Rules and Regulations **B. Rules and their interpretation and duties of officials.**	
	Throw Ball	**A. Fundamental skills:** Only Tennis Service, Air Service, two hand catching, one hand overhead return, side arm return. **Rules and their interpretations and duties of officials**	

Semester	Course Title	Content	No. Hours
V	**<u>Athletics</u> Track-** 110 &400 Mtrs Hurdles **Jumps-** High Jump **Throws-** Discuss Throw	**110 Mtrs and 400Mtrs:** Hurdling Technique :Lead leg Technique, Trail leg Technique ,Side Hurdling, Over the Hurdles Crouch start (its variations) use of Starting Block. Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. **High jump**: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. **Discus Throw**: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle).	Total 32 Hrs 2 Hrs/Week
	Foot Ball	**A. Fundamental Skills** 1. Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick. 2.Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot. 3.Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot. 4.Heading: In standing, running and jumping condition. 5.Throw-in: Standing throw-in and Running throw-in. 6.Feinting: With the lower limb and upper part of the body. 7.Tackling: Simple Tackling, Slide Tackling. 8.Goal Keeping: Collection of Ball, Ball clearance- kicking, throwing and deflecting. 9.Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials.**	
	Hockey	**A. Fundamental Skills** 1.Passing: Short pass, Long pass , push pass, Scooping hit 2.Trapping. 3.Dribbling and Dozing. 4.Penalty stroke practice. 5.Penalty corner practice. 6.Tackling: Simple Tackling, Slide Tackling. 7.Goal Keeping, Ball clearance- kicking, and deflecting. 8.Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials.**	

Semester	Course Title	Content	No. Hours
VI	**CRICKET**	**A. Fundamental Skills** **1.** Batting - Forward Defense Stroke, Backward Defense Stroke, Off Drive, On Drive, Straight Drive, Cover Drive, Square Cut. **2.** Bowling -Out-swing, In-swing, Off Break, Leg Break and Googly. **3.** Fielding: Catching - The High Catch, The Skim Catch, The Close Catch and throwing at the stumps from different angles. Long Barrier and Throw, Short Throw, Long Throw,Throwing on the Turn. **4.** Wicket Keeping **B. Rules and their interpretation and duties of officials**	Total 32 Hrs 2 Hrs/Week
	BASEBALL	A. **Fundamental Skills** Player Stances – walking, extending walking, L stance, cat stance Grip – standard grip, choke grip Batting – swing and bunt. Pitching Baseball : slider, fast pitch, curve ball, drop ball, rise ball, change up, knuckle ball, screw ball, **Rules and their interpretation and duties of officials.**	
	Athletics Combined Events- Heptathlon & Decathlon **Jumps**- Pole Vault **Throws**- Hammer Throw	Combined Events: Heptathlon all the 7 events Decathlon: All 10 Events **Pole Vault**: Approach Run, Planting the Pole,Take-off, Bar Clearance and Landing. **HammerThrow**: Holding the Hammer, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle).	

Semester	Course Title	Content	No. Hours
VII	**Basket ball**	**A. Fundamental Skills** 1.Passing: Two hand Chest Pass, Two hands Bounce Pass, One hand Baseball Pass, Side arm Pass, Overhead Pass, Hook Pass. 2.Receiving: Two hand receiving, One hand receiving, Receiving in stationary position, Receiving while Jumping and Receiving while Running. 3.Dribbling: How to start dribble, drop dribble, High Dribble, Low Dribble, Reverse Dribble, Rolling Dribble. 4.Shooting: Lay-up shot and its variations, One hand set shot, Two hands jump shot, Hook shot, Free Throw. 5.Rebounding: Defensive rebound and Offensive rebound. 6.Individual Defence: Guarding the player with the ball and without the ball, Pivoting. 7.Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials**	Total 32 Hrs 2 Hrs/Week
	Netball	**A. Fundamental skills** 1.Catching: one handed, two handed, with feet grounded and in flight. 2.Throwing (Different passes and their uses): One hand passes (shoulder, high shoulder, underarm, bounce, lob), two hand passes (Push, overhead and bounce). 3.Footwork: Landing on one foot, landing on two feet, Pivot, Running pass. 4. Shooting: One hand, forward step shot, and backward step shot. 5.Techniques of free dodge and sprint, sudden sprint, sprint and stop, sprinting with change at speed. 6. Defending: Marking the player, blocking, inside the circle, outside the circle. Defending the circle edge against the passing. 7. Intercepting: Pass and shot. 8. Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials**	

Semester	Course Title	Content	No. Hours
VIII	**Individual games** Shuttle Badminton	**A. Fundamental skills** 1.Basic Knowledge: Various parts of the Racket and Grip. 2.Service: Short service, Long service, Long-high service. 3.Shots: Over head shot, Defensive clear shot, Attacking clear shot, Drop shot, Net shot, Smash. 4.Game practice with application of Rules and Regulations. **B. Rules and their interpretations and duties of the officials.**	Total 32 Hrs 2 Hrs/Week
		A. Fundamental skills 1. Basic Knowledge: Various parts of the Racket and Grip (Shake Hand & Pen Hold Grip). 2. Stance: Alternate & Parallel. 3. Push and Service: Backhand & Forehand. 4. Chop: Backhand & Forehand. 5. Receive: Push and Chop with both Backhand & Forehand. 6. Game practice with application of Rules and Regulations. **B. Rules and their interpretations and duties of the officials**	
	Table Tennis	**A. Fundamental Skills** 1. Catching, Throwing and Ball control, 2. Goal Throws: Jump shot, Center shot, Dive shot, Reverse shot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, GoalKeeping and Defensive skills. 6. Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials**	
	Handball	**A. Fundamental skills**1. Basic Knowledge: Basic Skills Service: Short service, Long service, Long-high service.3. Shots: Over head shot, Defensive clear shot, Attacking clear shot, Drop shot, Net shot, Smash.4. Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials**	

REFERENCES

1. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
3. Petipus, et al. Athlete's Guide to Career Planning, Human Kinetics.
4. Dharma, P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, New Delhi.
5. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
6. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, New Delhi.
7. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
8. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
9. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
10. Dubey, H. C. Basketball, Discovery Publishing House, New Delhi.
11. Rachana Jain, Teach Yourself Basketball, Sports Publication.
12. Jack Nagle, Power Pattern Offences for Winning asketball, Parker Publishing Co., New York.
13. Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
14. Sally Kus, Coaching Volleyball Successfully, Human Kinetics.
15. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani. 16 Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
16. Test and Measurement (by Cleark and Cleark)
17. Evaluation in Physical Education (by Dr. Devendraya Kausal)
18. Methods of Physical Education (by Haridrash & Prof. Tirumalay Swamy)
19. Athletics (by Hardayal Singh)
20. Efficienting and Coaching (by Dr. Anand Nadigri)
21. Modern and Ancient History of Physical Education (by Dr. D. M. Jyothi)
22. Organization and Administration (by K. G. Nadigir or Vastrad)

YOGA AND MEDITATION

[As per Choice Based Credit System (CBCS) Scheme]
(From the academic year 2022-23)

Course Code	22YO39	CIE Marks	50
Credits	00	SEE Marks	00
Course Type	Practical		
Lecture Hours/Week (L-T-P)	0-0-2	Total Marks	50
Total Hours	28 Hours	SEE Hours	--

Semester	Content
III	1) Introduction of Yoga, Aim and Objectives of yoga, Prayer 2) Brief introduction of yogic practices for common man 3) Rules and regulations 4) Misconceptions of yoga 5) Suryanamaskara 6) Different types of Asanas a. Sitting b. Standing c. Prone line d. Supine line
IV	1) Patanjali's Ashtanga Yoga 2) Suryanamaskara 3) Different types of Asanas a. Sitting b. Standing c. Prone line d. Supine line 4) Kapalbhati 5) Pranayama
V	1) Patanjali's Ashtanga Yoga 2) Suryanamaskara 3) Different types of Asanas a. Sitting b. Standing c.Prone line d.Supine line 4) Kapalbhati 5) Pranayama

VI	1) Patanjali's Ashtanga Yoga 2) Suryanamaskara 3) Different types of Asanas a.Sitting b.Standing c.Prone line d.Supine line 4) Kapalbhati 5) Pranayama
VII	1) Patanjali's Ashtanga Yoga 2) Suryanamaskara 3) Different types of Asanas a.Sitting b.Standing c. Prone line d. Supine line 4) Kapalbhati 5) Pranayama
VIII	1) Patanjali's Ashtanga Yoga 2) Suryanamaskara 3) Different types of Asanas a. Sitting b. Standing c. Prone line d. Supine line 4) Kapalbhati 5) Pranayama 6) Shat Kriyas

Notes:

- One Hour of Lecture is equal to 1 Credit
- One Hour of Tutorial is equal to 1 Credit (Except Languages)
- Two Hours of Practical is equal to 1 Credit
- SEE : Semester End Examination
- CIE : Continuous Internal Examination
- L+T+P : Lecture + Tutorial + Practical

Guidelines

Semester	Course Title	Content	No. of Hours
3rd Semester	Introduction of Yoga, Aim and Objectives of yoga, Prayer	Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer	Total 32 hrs 2 hrs / week
	Brief introduction of yogic practices for common man	Yogic practices for common man to promote positive health	
	Rules and regulations	Rules to be followed during yogic practices by practitioner	
	Misconceptions of yoga	Yoga its misconceptions, Difference between yogic and non yogic practices	
	Suryanamaskara	Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar 12 count, 2 rounds	
	Different types of Asanas e. Sitting 1. Padmasana 2. Vajrasana f. Standing 1. Vrikshana 2. Trikonasana g. Prone line 1. Bhujangasana 2. Shalabhasana h. Supine line 1. Utthita dvipadasana 2. Ardha halasana	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana	
4th Semester	Patanjali's Ashtanga Yoga 1. Yama 2. Niyama	Patanjali's Ashtanga Yoga its need and importance. Yama :Ahimsa, satya, asteya, brahmacarya, aparigraha Niyama : shoucha, santosh, tapa, svaadhyaya, Eshvara pranidhan	Total 32 hrs 2 hrs / week
	Suryanamaskara	Suryanamaskar 12 count 4 rounds	
	Different types of Asanas e. Sitting 1. Sukhasana 2. Paschimottanasana f. Standing 1. Ardhakati Chakrasana 2. Parshva Chakrasana g. Prone line 1. Dhanurasana h. Supine line 1. Halasana 2. Karna Peedasana	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana	
	Kapalabhati	Meaning, importance and benefits of Kapalabhati. 40 strokes/min 3 rounds	
	Pranayama – 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana 4. Chandra Bhedana 5. Nadishodhana	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama	

5th Semester	Ashtanga Yoga 3. Asana 4. Pranayama	Patanjali's Ashtanga Yoga its need and importance.	Total 32 hrs 2 hrs / week
	Suryanamaskara	Suryanamaskar 12 count 6 rounds	
	Different types of Asanas a. Sitting 1. Ardha Ushtrasana 2. Vakrasana b. Standing 1. Urdhva Hastothanasana 2. Hastapadasana c. Prone line 1. Padangushtha Dhanurasana d. Supine line 1. Sarvangasana 2. Chakraasana	Asana, Need, importance of Asana. Different types. Asana its meaning by name, technique, precautionary measures and benefits of each asana	
	Kapalabhati	Revision of practice 50 strokes/min 3 rounds	
	Pranayama – 1. Surya Bhedana 2. Ujjayi	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama	
6th Semester	Ashtanga Yoga 5. Pratyahara 6. Dharana	Patanjali's Ashtanga Yoga its need and importance.	Total 32 hrs 2 hrs / week
	Suryanamaskara	Revision of practice 12 count 8 rounds	
	Different types of Asanas a. Sitting 1. Aakarna Dhanurasana 2. Yogamudra in Padmasana b. Standing 1. Parivritta Trikonasana 2. Utkatasana c. Prone line 1. Poorna Bhujangasana / Rajakapotasana d. Supine line 1. Navasana/Noukasana 2. Pavanamuktasana	Asana, Need, importance of Asana. Different types, Asana by name, technique, precautionary measures and benefits of each asana	
	Kapalabhati	Revision of practice 60 strokes/min 3 rounds	
	Pranayama – 1. Sheetali 2. Sheektari	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama	
7th Semester	Ashtanga Yoga 1. Dhyana (Meditation) 2. Samadhi	Patanjali's Ashtanga Yoga its need and importance.	Total 32 hrs 2 hrs / week
	Suryanamaskara	Revision of practice 12 count 10 rounds	
	Different types of Asanas a. Sitting 1. Vibhakta Paschimottanasana 2. Yogamudra in Vajrasana b. Standing 1. Parshvakonasana 2. Ekapadbaddhapadmottanasana c. Prone line balancing 1. Mayurasana d. Supine line 1. Sarvangasana 2. Setubandhasana 3. Shavasanaa (Relaxation poisture)	Asana, Need, importance of Asana. Different types, Asana by name, technique, precautionary measures and benefits of each asana	
	Kapalabhati	Revision of practice 80 strokes/min 3 rounds	

	Pranayama – 1. Bhastrika 2. Bhramari	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama	
8th Semester	Suryanamaskara	Revision of practice 12 count 12 rounds	Total 32 hrs 2 hrs / week
	Different types of Asanas a. Sitting 1. Bakasana 2. Hanumanasana 3. Ekapada Rajakapotasana b. Standing 1. Vatayanasana 2. Garudasana 3. Natarajasana c. Balancing 1. Sheershasana d. Supine line 1. Setubandha Sarvangasana 2. Shavasanaa (Relaxation poisture)	Asana, Need, importance of Asana. Different types, Asana by name, technique, precautionary measures and benefits of each asana	
	Kapalabhati	Revision of practice 100 strokes / min, 3 rounds	
	Pranayama – 1. Nadishodhana 2. Ujjai 3. Bhramari	Revision of practices	
	Shat Kriyas 1. Jalaneti & sutraneti 2. Nouli (only for men) 3. Sheetkarma Kapalabhati	Meaning, Need, importance of Shatkriya. Different types. Meaning by name, technique, precautionary measures and benefits of each Kriya	

Book for Reference:

·Swami Kuvulyananda : Asma (Kavalyadhama, Lonavala)
·Tiwari, O P : Asana Why and How
·Ajitkumar : Yoga Pravesha (Kannada)
·Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
·Swami Satyananda Saraswati : Surya Namaskar (Bihar School of yoga, Munger)
·Nagendra H R : The art and science of Pranayama
·Tiruka : Shatkriyegalu (Kannada)
·Iyengar B K S : Yoga Pradipika (Kannada)
·Iyengar B K S : Light on Yoga (English)

B.E IV Sem

ENGINEERING THERMODYNAMICS			
Subject Code	22ME41	Credits: 03	CIE: 50
Number ofLectureHours/Week	3 (Theory)		SEE: 50
Total Number of Lecture Hours	42		SEE Hours: 03

Prerequisites:

1. Students should necessarily have knowledge of some very basic knowledge of Chemistry
2. Students should have the knowledge of differential equations and high-level algebra.

Course objectives:

After studying this course, student will be able:

1. To study fundamentals of thermodynamics, its laws, energy interactions, work and heat
2. To provide the detailed information of thermodynamic laws and entropy principle and its applications
3. To learn about gas power and vapor power cycles
4. To learn about the working of reciprocating Air compressor and combustion of fuels
5. To understand refrigeration cycles. And psychrometric process

Modules	Teaching Hours
MODULE - I **INTRODUCTION:** Macroscopic and microscopic view point. Thermodynamic system. Thermodynamic properties, processes and cycles. Homogeneous and heterogeneous system. Thermodynamic equilibrium, quasi-static process, Work transfer, P-dv work for different thermodynamic process Comparison of heat and work. Numerical **FIRST LAW OF THERMODYNAMICS:** First law for a closed system undergoing a cycle, change of state, proof of energy as property of the system Different forms of stored energy, specific heat at constant volume and constant pressure, enthalpy, PMM-I and, steady flow process application steady flow process for compressor, Turbine, and Nozzle.Numerical	**9 Hours**
MODULE II **SECOND LAW OF THERMODYNAMICS:** Cyclic heat engine, and Carnot cycle, Kelvin-Planck and Clausius statements of second law of thermodynamics. Equivalence of Kelvin Planck and Clausius statement. Numerical **ENTROPY:** Definition of Entropy, Clausius Theorem, Property of entropy, Inequality of Clausius, Entropy principle, Application of Entropy. Numerical	**8 Hours**
MODULE III **GAS POWER CYCLES:** Air standard Otto, Diesel and Dual cycles. Air standard of Brayton cycle, reheat, Numerical. **IDEAL VAPOR POWER CYCLES:** Introduction to vapor power cycle, Carnot vapor power cycle, Simple Rankin cycle.Numerical	**8 Hours**
MODULE - IV **AIR COMPRESSOR:** Classification of air compressor and air compressor terminology. Reciprocating air compressor, working of single stage compressor, equation of work neglecting and considering clearance volume. Volumetric efficiency, Numerical. **COMBUSTION:** Introduction to solids, liquid and gaseous fuels–stoichiometry, exhaust gas analysis, combustion of fuels, enthalpy of formation, numerical.	**8 Hours**
MODULE - V **REFRIGERATION**: Introduction to refrigeration, and classification. Refrigerating effect, ton of refrigeration and COP, Desirable properties of refrigerant, Bell Coleman cycle, and analysis of ideal vapor compression refrigerator. Numerical **PSYCHROMETRY:**Introduction, definitions of dry air, and atmospheric air, specific and relative humidity, due point temperature, dry bulb (DBT), wet bulb temperature (WBT) and saturation, Psychometric chart and various process, Sensible cooling and heating, humidification and dehumidification, Numerical	**9 Hours**

Question paper pattern:

1. Total of Ten Questions with two from each MODULE to be set covering the entire syllabus.
2. Five full questions are to be answered choosing at least one from each MODULE.
3. Each question should not have more than 4 sub divisions.

TEXT BOOKS:

1. Basic and applied thermodynamics: P K Nag, Tata Mc Graw Hill Co.Ltd, New Delhi
2. Thermodynamics- An engineering approach: Yunus A Congel and Michael Boles, Tata McGraw Hill Publishing Co. Ltd, New Delhi

REFERENCE BOOKS:

1. Thermal engineering By R K Rajput, Laxmi publication Pvt, Ltd, New Delhi.
2. Thermodynamics :S C Gupta, Pearson Education PP (Singapore) Pvt. Ltd, Delhi

Course outcomes: At the end of the course students will be able to:

CO	Course Outcome (COs)
CO1	Apply the knowledge of basic thermodynamics to understand the concepts of system, thermodynamic properties, equilibrium, and to analyze the open and closed systems and understanding the energy balance in simple steady flow process
CO2	Evaluate the second law of thermodynamics of Kelvin Planck and Clausius theorem, and calculate the entropy and identifying application of entropy principle
CO3	Apply the knowledge of applied thermodynamics to understand the concept of different cycles and analyzing of gas power cycles and vapor power cycles.
CO4	Compute the Air compressor energy using single stage, and multi stage, single cylinder, multi cylinder. And combustion of fuels.
CO5	Asses the performance of refrigeration and Understanding the Psychrometric and finding their application in the Engineering field.

THEORY OF MACHINES			
Subject Code	22ME42	Credits: 04	CIE: 50
Number of Lecture Hours/Week	3 (Theory) +2(Practical)		SEE: 50
Total Number of Lecture Hours	42		SEE Hours: 03

Prerequisites:

1. Students should necessarily have knowledge of motions and displacement, velocity and acceleration of linear rotational and translational objects
2. Students should have the knowledge of drawing and sketching skills.

Course objectives:

After studying this course, student will be able:

1. To understand different types of motions exhibited in different machines and mechanisms.
2. To understand the force-motion relationship in components to external forces and analysis of standard mechanism
3. To understand the dynamic analysis of machine and design of flywheel
4. To understand the principles in mechanisms used for speed control and stability control
5. To make aware of different mechanisms and gear train and also cams

Modules	Teaching Hours
MODULE - I **INTRODUCTION:** Definitions,Link or element, kinematic pairs, degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion, Machine. Kinematic chains and inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain. **MECHANISMS:** Quick return motion mechanisms -Drag link mechanism, Whitworth mechanism and crank and slotted lever Mechanism. Straight line motion mechanisms – Peaucellier's mechanism and Robert's mechanism. Toggle mechanism, Pantograph, Steering gear mechanisms.	**8 Hours**
MODULE II **STATIC FORCE ANALYSIS:** Introduction: Static Equilibrium. Equilibrium of Two and Three Force Members, Members with Two Forces and Torque, Free Body Diagrams. Static Force Analysis of Four Bar Mechanism and Slider-Crank Mechanism without friction. **FLYWHEELS:** Significance of flywheel, turning moment and crank effort diagrams for reciprocating machines, coefficient of fluctuation of speed and energy, Limiting velocity of flywheel, Design of flywheels for engines.	**8 Hours**
MODULE III **FRICTION DEVICES (CLUTCHES):** Classification of clutches, torque transmission capacity, considerations for uniform wear and uniform pressure theory, single plate and multi-plate clutch, cone clutch. **BALANCING OF ROTATING MASSES:** Static and Dynamic Balancing, Balancing of Single Rotating Mass by Balancing Masses in Same plane and in Different planes. Balancing of Several Rotating Masses by Balancing Masses in Same plane and in Different planes.	**10 Hours**
MODULE - IV **GOVERNORS:** Types of Governors: Force Analysis of Porter and Hartnell Governors. Controlling Force, Stability, Sensitiveness, Isochronism, Effort and Power	**8 Hours**

GYROSCOPE: Vectorial Representation of Angular Motion, Gyroscopic Couple. Effect of Gyroscopic Couple on Ship, Plane Disc, Aeroplane, Stability of Two Wheelers and Four Wheelers.	
MODULE - V **GEAR TRAINS:** Simple gear trains, Compound gear trains for large speed reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains. **CAMS:** Types of cams, Types of followers, Displacement, Velocity and Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-faced follower, Disc cam with oscillating roller follower, Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.	**8 Hours**

Question paper pattern:

1. Total of Ten Questions with two from each MODULE to be set covering the entire syllabus.
2. Five full questions are to be answered choosing at least one from each MODULE.
3. Each question should not have more than 4 sub divisions.

Textbook/s
1. Theory of Machines, Rattan S.S, McGraw-Hill Education, 2nd edition, 2005. 2. Theory of Machines, Sadhu Singh, Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi 2nd edition, 2006.
Reference Books
1. Theory of Machines & Mechanisms, Shigley.J.V. and Uickers J.J., OXFORD University Press.3rdedition2004 2. Theory of Machines, Robert L. Norton, McGraw-Hill Higher Education, 3rdedition2006

Course outcomes: At the end of the course students will be able to:	
CO	**Course Outcome (COs)**
CO1	Construct/Compose mechanisms to provide specific motion.
CO2	To understand forces acting on the mechanisms and design of flywheel
CO3	To understand the balancing of machineries and design of clutches
CO4	To analyze the effect of a gyroscopic couple on Ship, Aeroplane and an Automobile.
CO5	To understand gears & gear train and construct cam profile for the specific follower motion.

DESIGN LAB

PREREQUISITE:

1. Must have studied theory of machines.
2. Must have knowledge of mechanical vibrations.

COURSE OBJECTIVES:

1. To learn how to analyze the motions of mechanisms, and analyze forces in machines.
2. To teach students concepts of dynamic forces in governors and gyroscope.
3. To make the students to analyze the different types of vibrations.
4. To understand the whirling speed of shaft and its effect.
5. To make the students to analyze pressure distribution in journal bearing.

EXPERIMENTS

Module-I

1. ***To verify the relation*** $T = 2\pi\sqrt{\frac{L}{g}}$ ***for Simple Pendulum***
2. To verify the relation $T = 2\pi\sqrt{\frac{k^2 + (OG)^2}{g(OG)}}$ for Compound Pendulum
3. To study the torsional vibration (undamped) of single rotor shaft system.
4. To study the torsional vibration (undamped) of two rotor shaft system.
5. To study the damped torsional vibration.
6. To study the forced vibrations of equivalent spring mass system
7. To find the whirling or critical speed of a given shaft

Module-II

1. To study the performance of the Watt Governor
2. To study the performance of the Porter Governor
3. To study the performance of the Proell Governor
4. To study the performance of the Hartnell Governor
5. To find the gyroscopic couple of a given gyroscope and to verify the relation for gyroscopic couple, Cgyro = I x ω x ωp
6. To plot the radial pressure distribution in journal bearing.

SCHEME OF EXAMINATION:

Students have to conduct 2 experiments.

Write up about experiments (in 30 mins):	15 Marks
Conducting experiments, Calculations, and Graphs:	25 Marks
Viva- Voice:	10 Marks
Total:	50 Marks

Course outcomes: At the end of the course students will be able to:

CO	Course Outcome (COs)
CO1	Students are able to calculate the forces on the dynamics of machines and correlate the theoretical results with experimental
CO2	Evaluate techniques for studying motion of machines and their components
CO3	Apply thereafter knowledge to experimental set up of vibration
CO4	Demonstrate the vibration phenomenon
CO5	Investigate to generate of experimental setup

CIE AND SEE FOR THE INTEGRATED PROFESSIONAL CORE COURSE (IPCC) WITH 4 CREDITS (L-T-P (3-0-2))

a) CIE THEORY COMPONENT

The CIE theory component constitutes of

- CIE - Internal Assessment Test with maximum 15 marks with minimum passing 6 marks
- CIE - Continuous and Comprehensive Assessment with maximum 10 marks with minimum passing 4 marks
- There shall be three Continuous Internal Evaluations (CIE)
- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.
- The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.
- The cumulative marks of the three CIE are to be divided by 6 to reduce the final CIE marks to a maximum of 15 marks and the minimum passing mark for this is 6.
- Another 10 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests, etc, and the minimum passing mark for this is 4. (If the assessment is mini-project based then only one assessment method may be adopted or otherwise, any two assessment tools may be used.
- The laboratory component of the IPCC shall be for CIE only no SEE.

b) CIE PRACTICAL COMPONENT

The CIE practical component constitutes of

- CIE Practical with maximum 15 marks and minimum passing 6 marks
- CIE Practical Test with maximum 10 marks and minimum passing 4 marks
- The maximum marks dedicated for conducting the experiments and preparation of laboratory records is 15 with minimum passing marks 6.
- The final CIE practical test for 50 marks to be conducted after completion of all the experiments and the scored marks is reduced to the maximum of 10 with minimum passing marks 4.

The maximum marks for both CIE theory and Practical is 50 and minimum passing marks is 20

MATERIALS SCIENCE & METALLURGY			
Subject Code	22ME43	Credits: 04	CIE: 50
Number of Lecture Hours/Week	3 (Theory) +2(Practical)		SEE: 50
Total Number of Lecture Hours	42		SEE Hours: 03

Prerequisites:

1. Students should necessarily have basics of Physics, Chemistry, and Manufacturing process.

Course objectives:

To enable the students to obtain the knowledge of Materials Science:

- To study understand structure-Properly relationships of various engineering materials.
- To learn mechanical failure modes of materials.
- To provide a detailed interpretation of binary phase diagrams.
- To understand the fundamentals of Fe-C diagram, Heat treatment of steel and TTT diagram.

Modules	Teaching Hours
Module - I **Materials of Engineering:** Historical Perspective about the materials, the Materials world, Selection strategy of engineering materials to design a component/part. (Translation, screening, ranking and documentation). Types of engineering materials and its significance. **Crystal Structure and Imperfections:** Seven systems and fourteen lattices, Lattice positions, Directions and planes. The solid solution –Types, chemical imperfections.	**10 Hours**
Module - II **Mechanical Behavior of Metals:** Introduction, Concepts of stress and strain, Elastic, inelastic, resilience, strength, rigidity, toughness. **Elastic deformation:** Stress strain behavior, Plastic deformation: Tensile properties, True stress and strain, elastic recovery after Plastic deformation, Compressive, shear and torsional deformation, hardness. **Dislocation of Strengthening Mechanism:** Introduction, slip systems, slip in single crystals,plastic deformation of polycrystalline materials **Diffusion:** Introduction, Diffusion mechanisms, factors that influence diffusion., Recrystallization and grain growth.	**10 Hours**
Module - III **Failure of Materials:** Fracture: Fundamentals of fracture, Ductile and Brittle fracture, growth, impact fracture testing, **Fatigue:** Cyclic Stresses, The S-N curve, Crack initiation and propagation, Factors affecting fatigue life. **Creep:** Generalized creep behavior, stress and temperature. **Phase Diagrams:** The phase rule, the phase diagrams, complete solid solution problems, eutectic diagram with no solid solutions, problems, Eutectic diagram with limited solid solution, problem, Eutectoid diagram, The lever rule, Microstructure development during slow cooling.	**8 Hours**
Module- IV **The Iron-Carbon System**: The Fe-FeC phase diagram, Development of Microstructure in Iron-Carbon alloys, The influence of other alloying elements. **Kinetics-Heat treatment:** Time-Temperature transformation diagram, Cooling curves transformation on TTT diagram. **Heat treatment of steel**: Annealing, Normalizing, Hardening, Austempering, Martempering, Surface Hardening, Case hardening.	**8 Hours**

Module – V	
Ferrous Non-Ferrous Alloys: Designations and Classifications of steels, Stainless steels composition structure and properties, Types of cast irons composition structure and properties, BIS, AISI, SAE, designation of steels. Aluminum alloys, magnesium and beryllium alloys. **Advanced Engineering Materials:** Introduction, Particle-reinforced composites. Ceramic, fiber reinforced composites.	**6 Hours**

Question paper pattern:

1. Total of Ten Questions with two from each MODULE to be set covering the entire syllabus.
2. Five full questions are to be answered choosing at least one from each MODULE.
3. Each question should not have more than 4 sub divisions.

Text Books:

1. Introduction to Materials Science for Engineering, Sixth edition, James F, Shackelford, Pearson/Prentice, Hall Publications, New Jersey.
2. Materials Science for Engineering – An Introduction, Sixth edition, William D Calister, Tr. Wiley India Edition.

Reference Books:

1. The Science and Engineering of Materials, Fourth Edition, Donald R Askeland Pradeep, P Phule, Thomson, rooks/Cole. Mc Graw Hill Publications.
2. Physical Metallurgy, Sydney H Aunor, tata Mc Graw Hill Publications.
3. ASM handbook Volume 9: Metallography and microstructure, Ed, George F, Vander Voort, ASM International 2004.
4. Physical Metallurgy, V Raghavan, PH1.

Course outcomes: At the end of the course students will be able to:

CO	Course Outcome (COs)
CO1	Understand the basic concept of material science and Metallurgy.
CO2	Correlate structure – Properties relationships.
CO3	Understand phase terminology, binary systems and phase transformations in Fe-alloys.
CO4	Understand various heat treatment operations and to decide the heat treatment operation for a given component.
CO5	Know ferrous and non-ferrous and composite materials, select materials for a given application.

MATERIAL TESTING LAB	
Course Objectives: • To understand the measurement of mechanical properties of materials. • To understand the deformation behavior of materials • To understand the Kinematic and dynamic characteristics of mechanical devices. • To study the microstructures of different materials and correlate it with the properties.	
Modules	**Teaching Hours**
1. Uniaxial tension test on M.S Rod. 2. Compression test on wooden cube. 3. Shear and Bending test on UTM. 4. Impact test on Metallic specimens. 5. Brinell and Rockwell hardness test on metallic specimen. 6. Study of metallurgical microscope and the metallographic procedures. 7. Study of muffle furnace. 8. Microscopic examination of untreated and heat-treated metallic samples. 9. Magnetic particle, non-destructive test. 10. Radiography, non-destructive test.	**28 Hours**
Question paper pattern:	
At the end of the course students will be able to:	

CO	Course Outcomes
CO1	Demonstrate the metallographic techniques and the use of metallurgical microscopes.
CO2	Analyze and draw the microstructure of untreated and heat treated ferrous and non-ferrous materials.
CO3	Demonstrate the destructive test on UTM, tensile, bending, Shear and torsion and to measure parameters.
CO4	Demonstrate the hardness of a given metallic components using rock well and brinell hardness testing m/c.
CO5	Explore the flows presenting materials using NDT methods such as magnetic particle and ultrasonic tests

CIE AND SEE FOR THE INTEGRATED PROFESSIONAL CORE COURSE (IPCC) WITH 4 CREDITS (L-T-P (3-0-2))

a) CIE THEORY COMPONENT

The CIE theory component constitutes of

- CIE - Internal Assessment Test with maximum 15 marks with minimum passing 6 marks
- CIE - Continuous and Comprehensive Assessment with maximum 10 marks with minimum passing 4 marks

- There shall be three Continuous Internal Evaluations (CIE)

- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.

- The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.

- The cumulative marks of the three CIE is to be divided by 6 to reduce the final CIE marks to a maximum of 15 marks and the minimum passing mark for this is 6.

- Another 10 marks are dedicated to other assessment tools with suitable weightage for each, that

include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests, etc, and the minimum passing mark for this is 4. (If the assessment is mini-project based then only one assessment method may be adopted or otherwise, any two assessment tools may be used.

- The laboratory component of the IPCC shall be for CIE only no SEE.

b) CIE PRACTICAL COMPONENT

The CIE practical component constitutes of

- CIE Practical with maximum 15 marks and minimum passing 6 marks
- CIE Practical Test with maximum 10 marks and minimum passing 4 marks

- The maximum marks dedicated for conducting the experiments and preparation of laboratory records is 15 with minimum passing marks 6.
- The final CIE practical test for 50 marks to be conducted after completion of all the experiments and the scored marks is reduced to the maximum of 10 with minimum passing marks 4.

The maximum marks for both CIE theory and Practical is 50 and minimum passing marks is 20

COMPUTER AIDED DRAFTING (CAD) LAB			
Subject Code	**22MEL44**	**Credits: 01**	**CIE: 50**
Number of Lecture Hours/Week	**2 (Practical)**		**SEE: 50**
Total Number of Lecture Hours	**28**		**SEE Hours: 03**

PREREQUISITE: 1) Geometry of plane surfaces 2) Engineering Graphics: First angle projection, Orthographic projections, Isometric views/projections. 3) Computer/Laptop: Basic operations, Printer

COURSE OBJECTIVES:

1. To introduce to AUTOCAD software to create required drawings using various commands
2. To be able to create orthographic projections of a given object/casting in first angle projection using AUTOCAD software.
3. To be able to create sectional views of intricate object/casting in first angle projection using AUTOCAD software.
4. To be able to create isometric views of object/casting referring to its orthographic projections in first angle projection using AUTOCAD software.
5. To be able to dimension the figure, place the texts and take print out of the same.

Module-I	**Teaching Hours**
INTRODUCTION: Introduction to AUTOCAD software, Basic commands, Drawing commands and modifying commands. Creating simple figures using straight lines and circle commands. Block insertion, Concept of layers.	**3 Hours**
ORTHOGRAPHIC PROJECTIONS: Creating orthographic projections of given objects/castings following first angle projections, Linear dimensioning, Editing Dimension styles as per requirements, Placing and editing texts, Executing PRINT command properly.	**5 Hours**
SECTIONAL VIEWS: Concept of Section plane and its representation, Creating sectional views of intricate objects/castings. Dimensioning and Executing PRINT command properly. .	**6 Hours**
Module-II **ISOMETRIC VIEWS:** Creating Isometric views of objects/castings from their orthographic projections. Aligned dimensioning and placing the texts and arrows in proper direction, Executing PRINT command properly.	**8 Hours**
3D MODELLING: Introduction to basic 3D operations, creating simple 3D objects such as prisms and cylinders, Creating 3D models of combined solids (Maximum of 3 solids, not necessarily co axial)	**6 Hours**

Question paper pattern:

1.Two questions, one on drawing orthographic projections and the other on drawing pictorial view of given casting or machine component. (40 Marks) CIE I 20 CIE II 20

2.Viva – voce carries 10 Marks

Course outcomes:
On completion of the course, the student will have the ability to:

CO #	Course Outcome (CO)
CO1	Demonstrate the ability to construct an accurate 2-D drawing, to create and edit textual data utilizing appropriate drawing software ie AUTOCAD.
CO2	Perform editing and entity manipulation operations on selected geometry and to generate cross hatched sectional views and pattern fills using AUTOCAD.
CO3	Demonstrate the ability to fully dimension 2 -D geometry using linear, angular and associative and edit dimensioning style as required.
CO4	Demonstrate the ability to visualize and create 3-D objects on paper and dimension properly.
CO5	Demonstrate the plot command to generate paper drawings and understand the various basic commands to create simple 3D models using AUTOCAD software.

Text books:

1. Drawing standards, IS-696 /SP46, BIS Publication,Kollata,India
2. Machine Drawing, Fifth edition, K L Narayana, P Kannaiah, K Venkat reddy, New Age International Publications, New Delhi, India.
3. Machine Drawing, N D Bhatt, V M Panchal, Charotar publication, Anand, India

Reference Books:

1. CBT on Machine Drawing, Sonaversity, salem, Tamilnadu , India
2. Machine Drawing, K R Gopalkrishan , Subhash Publications,Bangalore, India

CIE FOR THE COURSES WITH 01 CREDIT:

CIE FOR THE LABORATORY COURSE

- Maximum of 30 marks is allotted for Practical CIE (Continuous Internal Evaluation) for conduction of experiments and preparation of laboratory records etc with minimum passing marks 12.
- The test after all experiments conducted for 50 Marks needs to be reduced to 20 and the minimum passing mark is 08.
- Maximum of 50 marks is allotted for the practical SEE with minimum passing marks 20.

ENGINEERING SCIENCE COURSE

NON TRADITIONAL MACHINING			
Subject Code	22ME45A	**Credits: 03**	**CIE: 50**
Number of Lecture Hours/Week	**3 (Theory)**		**SEE: 50**
Total Number of Lecture Hours	**42**		**SEE Hours: 03**

PREREQUISITE: To classify Non Traditional Machining Processes (NTM), one needs to understand and analyse the differences and similar characteristics between conventional machining processes and NTM processes.

COURSE OBJECTIVES:

1.Introduction of non-traditional machining methods and their difference with conventional machining methods
2.Different classification criteria of non-traditional machining methods and their classifications
3.Working principle of various non-traditional machining methods
4.Process details of various non-traditional machining methods
5.Applications, advantages and limitations of non-traditional machining.

Modules	Teaching Hours
Module-I **Introduction**: History, Classification, comparison between Traditional and non- Traditional Machining, process selections. **Mechanical Process**: Ultrasonic Machining-Definition-Mechanism of metal elements of the process- Tool feed mechanism. theories of mechanics of causing effect of parameter applications.	8 hrs
Module-II **Abrasive Jet Machining**: Principles - parameters of the process applications-advantages and advantages. **Thermal Metal Removal Process**: Electric discharge machining Principle of operation – mechanism of meta removal basic EDM circuitry-spark erosion get Analysis of relaxation type of circuit material removal rate in relaxation.	8 hrs
Module-III **Electro chemical and chemical processes**: Electro chemical machining (ECM) Classification ECM process-principle of ECM Chemistry of the ECM parameters of the processes-determination of the metal removal rate - dynamics of ECM process-Hydrodynamics of ECM process-polarization-.Tool Design-advantages and disadvantages - applications. Electro Chemical Grinding-Electro Chemical holding Electrochemical deburring.	8 hrs
Module-IV **Chemical Machining**: Introduction-fundamental principle types of chemical machining Maskants- Etchenes-Advantages and disadvantages-applications. **Plasma arc Machining**: Introduction-Plasma-Generation of Plasma and equipment Mechanism of metals removal, PAN parameters-process characteristics - type of torches applications.	7 hrs

Module V **Electron Beam Machining (EBM)**: Introduction-Equipment for production of Electron beam - Theory of electron beam machining Thermal & Non thermal types characteristics - applications. **Laser Beam Machining (LBM)**: Introduction-principle of generation of lasers Equipment and Machining procedure-Types of Lasers-Process characteristics-advantages and limitations-applications. **Ion Beam Machining**: Introduction-Mechanism of metal removal and associated equipment-process characteristics applications.	11 hrs

Question paper pattern:
1.Total of Ten Questions with Two questions from each Module to be set covering the entire syllabus.
2.Five full questions are to be answered selecting at least One full question from each Module.
3.Each question should not have more than 4 sub divisions.

Text books:
1. **New technology Institution of Engineers** - Bhattacharya - India
2. **Production Technology** - HMT - Tata Mc Graw Hill - ISBN-10; 0070964432

Reference Books:
1. **Modern Machining Process** - P.C Pandy & H.S. Shan - Tata McGraw Hill - ISBN: 0070965536 - Publishing Date: Feb-80
2. **Metals Hand Book** - ASM - Vol-3.
3. **Modern Manufacturing Method** - Adithan - New Age International (p) Limited – ISBN**:** 8122408176, 2007.
4. **Modern Machining Processes** - P.K. Mishra - Narosa Publishing House, New Delhi - 1997.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Recognize the importance of NTM methods and describe Ultrasonic machining process.
	CO2	Describe the importance of AJM and Electro Discharge machining processes, aspects related to MRR, surface finish.
	CO3	Understanding the working principle and applicability of the electro-chemical and chemical processes.
	CO4	Illustrate the working principle, advantages, process limitations of chemical machining and PAM
	CO5	Understand the principle and operations of EBM,LBM and IBM

Note: CIE FOR 03 CREDIT PROFESSIONAL CORE COURSE

The CIE theory component constitutes of

- CIE IA Test with maximum 25 marks and minimum passing 10 marks
- CIE CCAs with maximum 25 marks and minimum passing 10 marks
- There shall be three Continuous Internal Evaluations (CIE) for the courses with 03 credits.
- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.

The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.

The cumulative marks of the three CIE is to be divided by 3.6 to reduce the final CIE marks to a maximum of 25 marks and the minimum passing mark for this is 10.

Another 25 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests, etc, and the minimum passing mark for this is 10 (If the assessment is mini-project based then only one assessment method may be adopted or otherwise, any two assessment tools may be used.

SEMESTER END EXAMINATION (SEE):

Theory SEE will be conducted by scheduled timetable, with question papers for the subject (duration 03 hours).

The question paper shall be set for 100 marks.

- The duration of SEE is 03 hours. The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks.
- Students have to answer 5 full questions, selecting one full question from each module.
- The student has to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
- There will be 2 questions from each module. Each of the two questions under a module.

Environmental Studies			
Subject Code	**22ME45B**	**Credits: 03**	**CIE: 50**
Number of Lecture Hours/Week	**3 (Theory)**		**SEE: 50**
Total Number of Lecture Hours	**42**		**SEE Hours: 03**

PREREQUISITE: 1) Geometry of plane surfaces 2) Engineering Graphics: First angle projection, Orthographic projections, Isometric views/projections. 3) Computer/Laptop: Basic operations, Printer

COURSE OBJECTIVES:

- To create environmental awareness among the students
- To gain knowledge on different types of pollution in the environment.

Module	Teaching Hours
Module-I **Ecosystems (Structure and Function):** Forest, Desert, Wetlands, River, Oceanic and Lake. Biodiversity: Types, Value; Hot-spots; Threats and Conservation of biodiversity, Forest Wealth, and Deforestation.	**8Hours**
Module-II **Advances in Energy Systems (Merits, Demerits, Global Status and Applications):** Hydrogen, Solar, OTEC, Tidal and Wind. **Natural Resource Management (Concept and case-studies):** Disaster Management, Sustainable Mining, case studies, and Carbon Trading.	**8Hours**
Module-III **Environmental Pollution** (Sources, Impacts, Corrective and Preventive measures, Relevant Environmental Acts, Case-studies): Surface and Ground Water Pollution; Noise pollution; Soil Pollution and Air Pollution. **Waste Management & Public Health Aspects:** Bio-medical Wastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge. .	**8Hours**
Module-IV **Global Environmental Concerns** (Concept, policies and case-studies): Ground water depletion/recharging, Climate Change; Acid Rain; Ozone Depletion; Radon and Fluoride problem in drinking water; Resettlement and rehabilitation of people, Environmental Toxicology.	**9 Hours**
Module V **Latest Developments in Environmental Pollution Mitigation Tools (Concept and Applications):** G.I.S. & Remote Sensing, Environment Impact Assessment, Environmental Management Systems, ISO14001; Environmental Stewardship- NGOs. Field work: Visit to an Environmental Engineering Laboratory or Green Building or Water Treatment Plant or Waste water treatment Plant; ought to be Followed by understanding of process and its brief documentation.	**9Hours**

Text books:

1. Environmental studies, Benny Joseph, Tata McGraw-Hill 2nd edition 2012
2. Environmental studies, S M Prakash, pristine publishing house, Mangalore 3rd edition-2018

Reference Books:

1 Benny Joseph, Environmental studies, Tata McGraw-Hill 2nd edition 2009
2. M.Ayi Reddy Textbook of environmental science and Technology, BS publications 2007
3. Dr. B.S Chauhan, Environmental studies, university of science press 1st edition

CO #	Course Outcome (CO)
CO1	Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale,
CO2	Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
CO3	Demonstrate ecology knowledge of a complex relationship between biotic and a biotic component.

Note: CIE FOR 03 CREDIT PROFESSIONAL CORE COURSE

The CIE theory component constitutes of

- CIE IA Test with maximum 25 marks and minimum passing 10 marks
- CIE CCAs with maximum 25 marks and minimum passing 10 marks
- There shall be three Continuous Internal Evaluations (CIE) for the courses with 03 credits.
- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.

The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.

The cumulative marks of the three CIE is to be divided by 3.6 to reduce the final CIE marks to a maximum of 25 marks and the minimum passing mark for this is 10.

Another 25 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests, etc, and the minimum passing mark for this is 10 (If the assessment is mini-project based then only one assessment method may be adopted or otherwise, any two assessment tools may be used.

SEMESTER END EXAMINATION (SEE):

Theory SEE will be conducted by scheduled timetable, with question papers for the subject (duration 03 hours).
The question paper shall be set for 100 marks.

- The duration of SEE is 03 hours. The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks.
- Students have to answer 5 full questions, selecting one full question from each module.
- The student has to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
- There will be 2 questions from each module. Each of the two questions under a module.

Robotics and Automation			
Subject Code	**22ME45C**	**Credits: 03**	**CIE: 50**
Number of Lecture Hours/Week	**3 (Theory)**		**SEE: 50**
Total Number of Lecture Hours	**42**		**SEE Hours: 03**

COURSE OBJECTIVES:

- To identify potential areas for automation and justify need for automation.
- To select suitable major control components required to automate a process or an activity
- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study the control of robots for some specific applications.
-

Module	Teaching Hours
Module-I **Introduction to automation:** Basic elements of an automated system, advanced automation functions, levels of automation, process industries versus discrete manufacturing industries, continuous versus discrete control, computer process control. Hardware components for automation and process control, sensors, actuators, analog to digital converters, digital to analog converters, input/output devices for discrete data.	**8 Hours**
Module-II **Automated production lines:** Fundamentals of automated production lines, application of automated production lines, analysis of transfer lines, automated assembly systems, fundamentals of automated assembly systems, quantitative analysis of assembly systems, automatic identification methods, barcode technology, radio frequency identification, other AIDC technologies.	**8 Hours**
Module-III **Industrial Robotics:** Robotic configuration, robot anatomy and related attributes, robot control systems, end effectors, sensors in robotics, industrial robot applications, robot accuracy and repeatability, different types of robotics, various generations of robots, degrees of freedom – Asimov's laws of robotics dynamic stabilization of robots. .	**8 Hours**
Module-IV **Spatial descriptions and transformations:** Positions, orientations, and frames. Mappings: Changing descriptions from frame to frame. Operators: translations, rotations and transformations, transformation arithmetic transform equations, transformation of free vectors computational considerations, manipulator Kinematics, link description, link-connection description, actuator space joint space and Cartesian space..	**9 Hours**
Module V **Robot programming:** Introduction, levels of robot programming, requirements of robot programming language, problems pertaining to robot programming languages, offline programming systems, central issues in OLP systems, automating subtasks in OLP systems, simple programs on robot applications, sensors and its applicatons.	**9 Hours**

Text books:

1. Automation, Production systems, and computer integrated manufacturing-Mikell P.Groover 3rd edition, Pearson 2009
2. Industrial Robotics-Groover, Weiss, Nagel, McGraw Hill International, 2nd edition, 2012

Reference Books:

1. Robotics for Engineers –YoramKoren, McGraw Hill International, 1st edition, 1985.
2. Robotic Engineering - An Integrated approach, Klafter, Chmielewski and Negin, PHI, 1st edition, 2009.
3. An Introduction to Automated Process Planning Systems- Tiess Chiu Chang & Richard A. Wysk

Note: CIE FOR 03 CREDIT PROFESSIONAL CORE COURSE

The CIE theory component constitutes of

- CIE IA Test with maximum 25 marks and minimum passing 10 marks
- CIE CCAs with maximum 25 marks and minimum passing 10 marks
- There shall be three Continuous Internal Evaluations (CIE) for the courses with 03 credits.
- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.

The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.

The cumulative marks of the three CIE is to be divided by 3.6 to reduce the final CIE marks to a maximum of 25 marks and the minimum passing mark for this is 10.

Another 25 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests, etc, and the minimum passing mark for this is 10 (If the assessment is mini-project based then only one assessment method may be adopted or otherwise, any two assessment tools may be used.

SEMESTER END EXAMINATION (SEE):

Theory SEE will be conducted by scheduled timetable, with question papers for the subject (duration 03 hours).

The question paper shall be set for 100 marks.

- The duration of SEE is 03 hours. The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks.
- Students have to answer 5 full questions, selecting one full question from each module.
- The student has to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
- There will be 2 questions from each module. Each of the two questions under a module.

Micro Electro Mechanical Systems (MEMS)			
Subject Code	22ME45D	**Credits: 03**	**CIE: 50**
Number of Lecture Hours/Week	**3 (Theory)**		**SEE: 50**
Total Number of Lecture Hours	**42**		**SEE Hours: 03**

Course Objectives: This course will enable students to:

1. Understand overview of microsystems, their fabrication and application areas.
2. Working principles of several MEMS devices.
3. Develop mathematical and analytical models of MEMS devices.
4. Know methods to fabricate MEMS devices.
5. Various application areas where MEMS devices can be used.

Modules	Teaching Hours
Module-I **Overview of MEMS and Microsystems:** MEMS and Microsystem, Typical MEMS and Microsystems Products, Evolution of Microfabrication, Microsystems and Microelectronics, Multidisciplinary Nature of Microsystems, Miniaturization. Applications and Markets.	**8 Hours**
Module-II **Working Principles of Microsystems:** Introduction, Microsensors, Microactuation, MEMS with Microactuators, Microaccelerometers, Microfluidics. **Engineering Science for Microsystems Design and Fabrication**: Introduction, Molecular Theory of Matter and Intermolecular Forces, Plasma Physics, Electrochemistry.	**9 Hours**
Module-III **Engineering Mechanics for Microsystems Design:** Introduction, Static Bending of Thin Plates, Mechanical Vibration, Thermomechanics, Fracture Mechanics, Thin Film Mechanics, Overview on Finite Element Stress Analysis.	**9 Hours**
Module-IV **Scaling Laws in Miniaturization:** Introduction, Scaling in Geometry, Scaling in Rigid-Body Dynamics, Scaling in Electrostatic Forces, Scaling in Fluid Mechanics, Scaling in Heat Transfer.	**8 Hours**
Module V **Overview of Micromanufacturing:** Introduction, Bulk Micromanufacturing, Surface Micromachining, The LIGA Process, Summary on Micromanufacturing.	**9 Hours**

Text books:

1.Tai-Ran Hsu, MEMS and Micro systems: Design, Manufacture and Nanoscale Engineering, 2nd Ed, Wiley.

Reference Books:

1. Hans H. Gatzen, Volker Saile, JurgLeuthold, Micro and Nano Fabrication: Tools and Processes, Springer, 2015.
1. Dilip Kumar Bhattacharya, Brajesh Kumar Kaushik, Microelectromechanical Systems (MEMS), Cenage Learning.

Course outcomes: On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Appreciate the technologies related to Micro Electro Mechanical Systems.
	CO2	Understand design and fabrication processes involved with MEMS devices.
	CO3	Analyse the MEMS devices and develop suitable mathematical models
	CO4	Know various application areas for MEMS device

Note: CIE FOR 03 CREDIT PROFESSIONAL CORE COURSE

The CIE theory component constitutes of

- CIE IA Test with maximum 25 marks and minimum passing 10 marks
- CIE CCAs with maximum 25 marks and minimum passing 10 marks
- There shall be three Continuous Internal Evaluations (CIE) for the courses with 03 credits.
- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.

The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.

The cumulative marks of the three CIE is to be divided by 3.6 to reduce the final CIE marks to a maximum of 25 marks and the minimum passing mark for this is 10.

Another 25 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests, etc, and the minimum passing mark for this is 10 (If the assessment is mini-project based then only one assessment method may be adopted or otherwise, any two assessment tools may be used.

SEMESTER END EXAMINATION (SEE):

Theory SEE will be conducted by scheduled timetable, with question papers for the subject (duration 03 hours).

The question paper shall be set for 100 marks.

- The duration of SEE is 03 hours. The question paper will have 10 questions. Two questions per module. Each question is set for 20 marks.
- Students have to answer 5 full questions, selecting one full question from each module.
- The student has to answer for 100 marks and marks scored out of 100 shall be proportionally reduced to 50 marks.
- There will be 2 questions from each module. Each of the two questions under a module.

BIOLOGY FOR ENGINEERS

[As per Choice Based Credit System (CBCS) Scheme] (From the academic year 2022-23)

Subject Code:	22BSC46	Credits: 03	CIE: 50
Number of Lecture Hours/Week	3 (Theory)		SEE: 50
Total Number of Lecture Hours	42		Total Marks:100
			SEE Hours: 03

Course Objectives:

1.To familiarize the students with the basic biological concepts and their engineering applications.

2.To enable the students with an understanding of biodesign principles to create novel devices and structures.

3.To provide the students an appreciation of how biological systems can be re- designed as substitute products for natural systems.

4.To motivate the students to develop interdisciplinary vision of biological engineering.

Teaching-Learning Process(General Instructions):

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Explanation via real life problem, situation modelling, and deliberation of solutions, hands-on sessions, reflective and questioning /inquiry-based teaching.
2. Instructions with interactions in classroom lectures (physical/hybrid).
3. Use of ICT tools, including YouTube videos, related MOOCs, AR/VR/MR tools.
4. Flipped classroom sessions (~10% of the classes).
5. Industrial visits, Guests talks and competitions for learning beyond the syllabus.
6. Students' participation through audio-video based content creation for the syllabus (as assignments).
7. Use of gamification tools (in both physical/hybrid classes) for creative learning outcomes. 8. Students' seminars (in solo or group) /oral presentations

Modules	Hours
Module - I **INTRODUCTION TO BIOLOGY:** The cell: the basic unit of life, Structure and functions of a cell. The Plant Cell and animal cell, Prokaryotic and Eukaryotic cell, Stem cells and their application. Biomolecules: Properties and functions of Carbohydrates, Nucleic acids, proteins, lipids. Importance of special biomolecules; Enzymes (Classification (with one example each),Properties and functions), vitamins and hormones.	08 Hours

Module - II **BIOMOLECULES AND THEIR APPLICATIONS (QUALITATIVE):** Carbohydrates (cellulose-based water filters, PHA and PLA as bioplastics), Nucleic acids (DNA Vaccine for Rabies and RNA vaccines for Covid19, Forensics – DNA fingerprinting), Proteins (Proteins as food – whey protein and meat analogs, Plant based proteins), lipids (biodiesel, cleaning agents/detergents), Enzymes (glucoseoxidase in biosensors, lignolytic enzyme in bio-bleaching).	08 Hours
Module - III **HUMAN ORGAN SYSTEMS AND BIO DESIGNS (QUALITATIVE):** Brain as a CPU system (architecture, CNS and Peripheral Nervous System, signal transmission, EEG, Robotic arms for prosthetics. Engineering solutions for Parkinson's disease).Eye as a Camera system (architecture of rod and cone cells, optical corrections, cataract, lens materials, bionic eye). Heart as a pump system (architecture, electrical signalling - ECG monitoring and heart related issues, reasons for blockages of blood vessels, design of stents, pace makers, defibrillators). Lungs as purification system (architecture, gas exchange mechanisms, spirometry, abnormal lung physiology - COPD, Ventilators, Heart-lung machine). Kidney as a filtration system (architecture, mechanism of filtration, CKD, dialysis systems).	09 Hours
Module - IV **NATURE-BIOINSPIRED MATERIALS AND MECHANISMS (QUALITATIVE):** Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf). Bird flying (GPS and aircrafts), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro), Shark skin (Friction reducing swim suits), Kingfisher beak (Bullet train). Human Blood substitutes - hemoglobin-based oxygen carriers (HBOCs) and perflourocarbons (PFCs).	08 Hours
Module – V **TRENDS IN BIOENGINEERING (QUALITATIVE):** Muscular and Skeletal Systems as scaffolds (architecture, mechanisms, bioengineering solutions for muscular dystrophy and osteoporosis), scaffolds and tissue engineering, Bioprinting techniques and materials, 3D printing of ear, bone and skin. 3D printed foods. Electrical tongue and electrical nose in food science, DNA origami and Biocomputing, Bioimaging and Artificial Intelligence for disease diagnosis. Self healing Bioconcrete (based on bacillus spores, calcium lactate nutrients and biomineralization processes) and Bioremediation and Biomining via microbial surface adsorption (removal of heavy metals like Lead, Cadmium, Mercury, Arsenic).	09 Hours

Course outcome (Course Skill Set)

At the end of the course, the student will be able to :

1. Elucidate the basic biological concepts via relevant industrial applications and case studies.
2. Evaluate the principles of design and development, for exploring novel bioengineering projects.
3. Corroborate the concepts of biomimetics for specific requirements.
4. Think critically towards exploring innovative biobased solutions for socially relevant problems.

Suggested Learning Resources:Books·

1. Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar ν Rao N Publishing, Bengaluru, 2023.·
2. Human Physiology, Stuart Fox, Krista Rompolski, McGraw-Hill eBook. 16th Edition, 2022· ν
3.Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., ν Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.·
4.Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011·
5. Biomedical Instrumentation, Leslie Cromwell, Prentice Hall 2011.·
6. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.·
7. Biomimetics: Nature-Based Innovation, Yoseph Bar-Cohen, 1st edition, 2012, CRC Press.·
8. Bio-Inspired Artificial Intelligence: Theories, Methods and Technologies, D. Floreano and C Mattiussi, MIT Press, 2008.·
9.Bioremediation of heavy metals: bacterial participation, by C R Sunilkumar, N GeethaA C ν Udayashankar Lambert Academic Publishing, 2019.·
10. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, ν 2016.
11.Electronic Noses and Tongues in Food Science, Maria Rodriguez Mende, Academic Press, 2016 ν

Web links and Video Lectures (e-Resources):

https://nptel.ac.in/courses/121106008
https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists ·
https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009 ·
https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006 ·
https://www.coursera.org/courses?query=biology ·
https://onlinecourses.nptel.ac.in/noc19_ge31/preview ·
https://www.classcentral.com/subject/biology
https://www.futurelearn.com/courses/biology-basic-concepts

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1.Group Discussion of Case studies ·
2. Model Making and seminar/poster presentations ·
3.Design of novel device/equipment like Cellulose-based water filters, Filtration system

UNIVERSAL HUMAN VALUES			
Course Code	**22UHV47**	**Credits:1**	**CIE: 50**
Number of Lecture Hours/Week	**2hrs (Tutorial)**		**SEE: 50** **Total:100**
Total Number of Theory Hours	**28 hours**		**SEE Hours: 02**

Course Objectives:

This course is intended to:

· To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.

· To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.

· To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

· This course is intended to provide a much-needed orientation input in value education to the young enquiring minds.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.
3. State the need for UHV activities and its present relevance in the society and Provide real-life examples.
4. Support and guide the students for self-study activities.
5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
6. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous selfevolution.
7. Encourage the students for group work to improve their creative and analytical skills.

Modules	**Teaching Hours**
Module-I **Introduction to Value Education:** Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations.	06 hours

Module-II **Harmony in the Human Being :** Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.	05 hours
Module-III **Harmony in the Family and Society :** Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.	06 hours
Module-IV **Harmony in the Nature/Existence :** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence.	05 hours
Module-V **Implications of the Holistic Understanding – a Look at Professional Ethics:** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct,A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession.	06 hours

Suggested Learning Resources:
Books for READING:

Text Book and Teachers Manual

a. The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana,G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034- 47-1

b. The Teacher s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur,R Asthana, G

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj – Pandit Sunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)
14. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
15. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
16. A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.
17. P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
18. A N Tripathy, 2003, Human Values, New Age International Publishers.
19. SubhasPalekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.
20. E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers , Oxford University Press

21. M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.
22. B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books.
B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Web links and Video Lectures (e-Resources):

- Value Education websites,
- https://www.uhv.org.in/uhv-ii,
- http://uhv.ac.in,
- http://www.uptu.ac.in
- Story of Stuff,
- http://www.storyofstuff.com
- Al Gore, An Inconvenient Truth, Paramount Classics, USA
- Charlie Chaplin, Modern Times, United Artists, USA
- IIT Delhi, Modern Technology – the Untold Story
- Gandhi A., Right Here Right Now, Cyclewala Productions
- https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
- https://fdp-si.aicte-india.org/8dayUHV_download.php
- https://www.youtube.com/watch?v=8ovkLRYXIjE
- https://www.youtube.com/watch?v=OgdNx0X923I
- https://www.youtube.com/watch?v=nGRcbRpvGoU
- https://www.youtube.com/watch?v=sDxGXOgYEKM

Ability Enhancement Course /Skill Enhancement Course-IV

Introduction to AI & ML			
Subject Code:	22MEAE481	Credits: 01	CIE: 50
Number of Lecture Hours/Week	2 (Tutorial)		SEE: 50
Total Number of Lecture Hours	28		SEE Hours: 03

Course objectives:

1. To familiarize basic principles, and applications of AI
2. To guide the students on generalization as a means to capturing patterns in the data.
3. To demonstrate the reasoning to internal representations of knowledge.
4. To make to understand the of challenges in Artificial Intelligence domain.
5. To acquaint with the future trends of Artificial Intelligence.

Module	Total Hours
Module I Introduction to AI: Introduction, The Turing Test Approach, Cognitive Modeling Approach, Laws of thought Approach, Rational agent Approach, AI Methods and tools, Foundations of Artificial Intelligence, Goals of AI, Performing Natural Language Processing using Email Filters in Gmail, Performing Natural Language Generation using Smart replies in Gmail.	**6 Hours**
Module II Fundamentals of Machine Learning: Describing structural patterns, Machine Learning, Data Mining, Simple Examples, Fielded Examples, Machine Learning and statistics, Generalization as a search, Data mining and ethics.Data preprocessing using Weka, Handling high dimensional data through feature reduction in Weka.	**6 Hours**
Module III Machine Learning Tasks:Decision Tables, Decision Trees, Classification rules, Association rules, Rules with exceptions, Rules involving relations, Trees for numeric prediction, Instancebased representation, Clusters.Building soybean classification model using decision trees, generating association rules on weather data using Weka, Exploring Classification and Clustering techniques using scikit-learn or Weka.	**6 Hours**
Module IV Nature-inspired techniques in AI:Inspiration from brain, Perceptron, Artificial Neural Net, Unsupervised Learning, Genetic Algorithms. Weather Prediction through Neural Networks using Weka, Perform data labelling for various images using Supervisely.	**5 Hours**
Module V Deep Learning: Basics of Deep Learning, Medical Image Analysis using Tensor Flow or Supervisely. Present and Future trends: The social effects of AI, A World with Robots, AI and Art, The Future, Integration, Artificial agents.	**6 Hours**

Text Book:

1. BlayWhitby, Artificial Intelligence: A Beginners Guide, Second Edition, One World Publisher, 2008.
2. Ian H. Witten, Eibe Frank, Data Mining: Practical Machine Learning Tools and Techniques, Morgan Kaufman Publishers, 3rd Edition, 2011.

Reference Books:

1. AurélienGéron,Hands on Machine Learning with Scikit-Learn and TensorFlow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media,2017
2. Elaine Rich, Kevin Knight and Shivashankar B. Nair, Artificial Intelligence,TMH Education Pvt. Ltd., 2008.
3. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Pearson.

Course outcome (Course Skill Set) At the end of the course the student will be able to:	
CO1	Understand the basic principles and goals of AI tasks.
CO2	Outline the role of AI in different real-time applications
CO3	Construct a problem with the suitable AI task.
CO4	Demonstrate the importance of biology in AI.
CO5	Survey the future development of AI.

CIE FOR THE COURSES WITH 01 CREDIT

a) **CIE THEORY COMPONENT**

The CIE theory component constitutes of CIE IA Test with maximum 25 marks and minimum passing 10 marks

CIE CCAs with maximum 25 marks and minimum passing 10 marks

- There shall be three Continuous Internal Evaluations (CIE) for 1. Credit course
- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.
- The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.
- The cumulative marks of the three CIE is to be divided by 3.6 to reduce the final CIE marks to a maximum of 25 marks and the minimum passing mark for this is 10.
- Another 25 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests etc, and minimum passing marks for this is 10. (Any two assessment tools may be used. The assessment tools must be discussed and got approved by the concerned HoD before the commencement of the course)

b) SEMESTER END EXAMINATIONS:

- The SEE theory exam to be conducted for 50 marks with minimum passing marks 18.
- The SEE question paper with Multiple Choice Question (MCQs) type is set for 50 questions each of the 01 marks.

Introduction To Virtual Reality			
Subject Code:	22MEAE482	Credits: 01	CIE: 50
Number of Lecture Hours/Week	2 (Tutorial)		SEE: 50
Total Number of Lecture Hours	28		SEE Hours: 03

Course objectives:

1. Describe how VR systems work and list the applications of VR.
2. Understand the design and implementation of the hardware that enables VR systems to be built.
3. Understand the system of human vision and its implication on perception and rendering.
4. Explain the concepts of motion and tracking in VR systems.
5. Describe the importance of interaction and audio in VR systems.

Module	Total Hours
Module I **Introduction to Virtual Reality:** Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality.	**6 Hours**
Module II **Representing the Virtual World:** Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR	**6 Hours**
Module III **The Geometry of Virtual Worlds &The Physiology of Human Vision:** Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR.	**6 Hours**
Module IV **Visual Perception & Rendering:** Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates	**5 Hours**
Module V **Motion & Tracking:** Motion in Real and Virtual Worlds- Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Tracking-Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies	**5 Hours**

Text Book:

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.

Reference Books:

1. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.
3. Oliver Bimber and Ramesh Raskar, "Spatial Augmented Reality: Meging Real and Virtual Worlds", 2005.
4. Burdea, Grigore C and Philippe Coiffet, "Virtual Reality Technology", Wiley Interscience, India, 2003.

Web links and Video Lectures (e-Resources):

http://lavalle.pl/vr/book.html
https://nptel.ac.in/courses/106/106/106106138/
https://www.coursera.org/learn/introduction-virtual-reality.

Course outcome (Course Skill Set) At the end of the course the student will be able to:	
CO1	Describe how VR systems work and list the applications of VR.
CO2	Understand the design and implementation of the hardware that enables VR systems to be built.
CO3	Understand the system of human vision and its implication on perception and rendering.
CO4	Explain the concepts of motion and tracking in VR systems
CO5	Describe the importance of interaction and audio in VR systems.

CIE FOR THE COURSES WITH 01 CREDIT

a) **CIE THEORY COMPONENT**

The CIE theory component constitutes of CIE IA Test with maximum 25 marks and minimum passing 10 marks

CIE CCAs with maximum 25 marks and minimum passing 10 marks

- There shall be three Continuous Internal Evaluations (CIE) for 1. Credit course
- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.
- The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.
- The cumulative marks of the three CIE is to be divided by 3.6 to reduce the final CIE marks to a maximum of 25 marks and the minimum passing mark for this is 10.
- Another 25 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests etc, and minimum passing marks for this is 10. (Any two assessment tools may be used. The assessment tools must be discussed and got approved by the concerned HoD before the commencement of the course)

b) SEMESTER END EXAMINATIONS:

- The SEE theory exam to be conducted for 50 marks with minimum passing marks 18.
- The SEE question paper with Multiple Choice Question (MCQs) type is set for 50 questions each of the 01 marks.

Digital Marketing			
Subject Code:	22MEAE483	Credits: 01	CIE: 50
Number of Lecture Hours/Week	2 (Tutorial)		SEE: 50
Total Number of Lecture Hours	28		SEE Hours: 03

Course objectives:

1. To provide with the knowledge about business advantages of the digital marketing and its importance for marketing success;
2. To develop a digital marketing plan;
3. To make SWOT analysis;
4. To define a target group;
5. To get introduced to various digital channels, their advantages and ways of integration;
6. To integrate different digital media and create marketing content;
7. To optimize a Website and SEO optimization;
8. To create Google AdWords campaigns; social media planning;
9. To get basic knowledge of Google Analytics for measuring effects of digital marketing and gettinginsight of future trends that will affect the future development of the digital marketing.

Module	Total Hours
Module I Introduction to the Course and Work plan, Introduction of the digital marketing, Digital vs. Real Marketing, Digital Marketing Channels Creating initial digital marketing plan, Content management, SWOT analysis, Target group analysis, Web design, Optimization of Web sites, MS Expression Web	**6 Hours**
Module II SEO Optimization, Writing the SEO content Google AdWords- creating accounts, Google AdWords- types Introduction to CRM, CRM platform, CRM models	**6 Hours**
Module III Introduction to Web analytics, Web analytics – levels, Introduction of Social Media Marketing Creating a Facebook page, Visual identity of a Facebook page, Types of publications Business opportunities and Instagram options, Optimization of Instagram profiles, Integrating Instagram with a Web Site and other social networks, keeping up with posts.	**6 Hours**
Module IV Business tools on LinkedIn,Creating campaigns on LinkedIn, Analyzing visitation on LinkedIn Creating business accounts on YouTube, YouTube Advertising, YouTube Analytics Facebook Ads, Creating Facebook Ads, Ads Visibility.	**5 Hours**
Module V E-mail marketing, E-mail marketing plan, E-mail marketing campaign analysis, Keeping up with conversions Digital Marketing Budgeting- resource planning, cost estimating, cost budgeting, cost control.	**5 Hours**

Text Book:

1. Ryan, D. (2014). Understanding Digital Marketing
1. Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited

Reference Books:

1. The Beginner's Guide to Digital Marketing (2015). Digital Marketer
2. Pulizzi,J.(2014) Epic Content Marketing, Mc-Graw Hill Education.

Course outcome (Course Skill Set) At the end of the course the student will be able to:

CO1	To identify the importance of the digital marketing for marketing success,
CO2	To manage customer relationships across all digital channels and build better customer relationships,

CO3	To create a digital marketing plan, starting from the SWOT analysis and defining a target group, then identifying digital channels, their advantages and limitations,
CO4	To perceive ways of the integration taking into consideration the available budget.

CIE FOR THE COURSES WITH 01 CREDIT

a) **CIE THEORY COMPONENT**

The CIE theory component constitutes of CIE IA Test with maximum 25 marks and minimum passing 10 marks

CIE CCAs with maximum 25 marks and minimum passing 10 marks

- There shall be three Continuous Internal Evaluations (CIE) for 1. Credit course
- The CIE Question paper shall be set for a maximum of 30 marks with questions having a maximum of three bits.
- The question needs to be framed covering the entire syllabus (33%) completed before the consecutive CIEs.
- The cumulative marks of the three CIE is to be divided by 3.6 to reduce the final CIE marks to a maximum of 25 marks and the minimum passing mark for this is 10.
- Another 25 marks are dedicated to other assessment tools with suitable weightage for each, that include quizzes, assignments, mini-projects, presentations, case studies, surveys, group discussions, slip tests etc, and minimum passing marks for this is 10. (Any two assessment tools may be used. The assessment tools must be discussed and got approved by the concerned HoD before the commencement of the course)

b) SEMESTER END EXAMINATIONS:

- The SEE theory exam to be conducted for 50 marks with minimum passing marks 18.
- The SEE question paper with Multiple Choice Question (MCQs) type is set for 50 questions each of the 01 marks.

Introduction to Python

Subject Code	21MEAE484	Credits: 01	CIE: 50
Number of Lecture Hours/Week	02 LAB		SEE: 50
Total Number of Lecture Hours	28		SEE Hours: 03

Course objectives:

- Demonstrate the use of Anaconda or PyCharm IDE to create Python Applications.
- Develop Python programming language to develop programs for solving real-world problems.
- Utilize Object-Oriented Programming concepts in Python.
- Analyse the working of various documents like PDF, Word file.

S No	Experiments
01	Develop a python program to find the better of two test average marks out of three test's marks accepted from the user.
02	Develop a python program to find the smallest and largest number in a list
03	Develop a python program to arrange the numbers in ascending and descending order
04	Develop a binary search program in python
05	Develop a bubble sort program in python
06	Develop a Python program to check whether a given number is palindrome or not and also count the number of occurrences of each digit in the input number.
07	Write a Python program that accepts a sentence and find the number of words, digits, Uppercase letters and lowercase letters.
08	Write a Python program for pattern recognition with and without using regular expressions
	Demonstration Exercises (For CIE)
09	Demonstrate python program to read the data from the spreadsheet and write the data in to the spreadsheet.
10	Demonstration of reading, writing and organizing files.
11	Demonstration of the concepts of classes, methods, objects and inheritance.
12	Demonstration of working with PDF and word files.
	Course outcomes (Course Skill Set): At the end of the course the student will be able to: • Demonstrate proficiency in handling of loops and creation of functions. • Identify the methods to create and manipulate lists, tuples and dictionaries. • Discover the commonly used operations involving regular expressions and file system • Examine working of PDF and word file format

Suggested Learning Resources:

1. Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3" 1st Edition, CreateSpace Independent Publishing Platform, 2016. (http://do1.drchuck.com/pythonlearn/EN_us/pythonlearn.pdf)
2. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Green Tea Press, 2015. (http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Download pdf files from the above links)
3. Al Sweigart, "Automate the Boring Stuff with Python",1stEdition, No Starch Press, 2015. (Available under CC-BYNC-SA license at https://automatetheboringstuff.com/)
4. Reema Thareja "Python Programming Using Problem Solving Approach" Oxford University Press.

CIE FOR THE LABORATORY COURSE

- Maximum of 30 marks is allotted for Practical CIE (Continuous Internal Evaluation) for conduction of experiments and preparation of laboratory records etc with minimum passing marks 12.
- The test after all experiments conducted for 50 Marks needs to be reduced to 20 and the minimum passing mark is 08.
    - Maximum of 50 marks is allotted for the practical SEE with minimum passing marks 20.

NATIONAL SERVICE SCHEME (NSS)

[As per Choice Based Credit System (CBCS) Scheme]
(From the academic year 2022-23)

Course Code	22NS39	CIE Marks	50
Credits	00	SEE Marks	00
Course Type	Practical		
Lecture Hours/Week (L-T-P)	0-0-2	Total Marks	50
Total Hours	28 Hours	SEE Hours	--

Pre-requisites to take this Course:

1. Students should have a service oriented mind set and social concern.
2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.

Students should be ready to sacrifice some of the time and wishes to achieve service oriented targets on time.

Corse Objectives :National Service Scheme (NSS) will enable the students to:

1. Understand the community in which they work
2. Identify the needs and problems of the community and involve them in problem-solving
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony

1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing.
2. Waste management– Public, Private and Govt organization, 5 R's.
3. Setting of the information imparting club for women leading to contribution in social and economic issues.
4. Water conservation techniques – Role of different stakeholders– Implementation.
5. Preparing an actionable business proposal for enhancing the village income and approach for implementation.
6. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.
7. Developing Sustainable Water management system for rural areas and implementation approaches.
8. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath,Make in India, Mudra scheme, Skill development programs etc.
9. Spreading public awareness under rural outreach programs.(minimum5 programs).
10. Social connect and responsibilities.
11. Plantation and adoption of plants. Know your plants.

12. Organize National integration and social harmony events /workshops /seminars. (Minimum 02 programs).
13. Govt. school Rejuvenation and helping them to achieve good infrastructure.

ONENSS – CAMP @ College /University /Stateor Central GovtLevel /NGO's /General Social Camps

Students have to take up anyone activity on the above said topics and have to prepare content for awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same. Compulsorily students have to attend one camp.
CIE will be evaluated based on their presentation, approach and implementation strategies.

Course Outcomes:

After completing the course, the students will be able to

CO1: Under stand the importance of his / her responsibilities towards society.
CO2: Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.
CO4: Implement government or self-driven projects effectively in the field.

ASSESSMENT AND EVALUATION PATTERN		
WEIGHTAGE	**50%**	**50%**
	CIE	SEE
Presentation 1-Selectionoftopic-(phase 1)	**10**	*****
EXPERIENTIAL LEARNING Presentation 2(phase2)	**10**	*****
Case Study-based Teaching-Learning	**10**	• Implementation strategies of the project with report duly signed by the Dept's Coordinator, HoD & Principal. • At last It should be evaluated by the NSS Coordinator. • Finally consolidated report should be sent to the University.
Sector wise study & consolidation	**10**	
Video based seminar (4-5 minutes per student)	**10**	
TOTAL MARKSFORTHE COURSE	**50 MARKS**	**50 MARKS**

Suggested Learning Resource:

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.

PHYSICAL EDUCATION AND SPORTS

[As per Choice Based Credit System (CBCS) Scheme]
(From the academic year 2022-23)

Course Code	22PE39	CIE Marks	50
Credits	00	SEE Marks	00
Course Type	Practical		
Lecture Hours/Week (L-T-P)	0-0-2	Total Marks	50
Total Hours	28 Hours	SEE Hours	--

SEMESTER	COURSE
III	**Fitness Components** Kabaddi/ Kho Kho
IV	**Athletics** Volleyball Throw ball / Chess
V	**Athletics** Football/Hockey
VI	**Athletics** Cricket/Base ball
VII	**Athletics** Netball/Basketball
VIII	**Individual Games** Handball/ Badminton

Notes:

- One Hour of Lecture is equal to 1 Credit
- One Hour of Tutorial is equal to 1 Credit (Except Languages)
- Two Hours of Practical is equal to 1 Credit
- SEE : Semester End Examination
- CIE : Continuous Internal Examination
- L+T+P : Lecture + Tutorial + Practical

Semester	Course Title	Content	No. Hours
III	**Fitness** **Component** Speed Strength Endurance Agility Flexibility	Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. ***Practical Components: Speed, Strength, Endurance, Flexibility, and Agility*** **KABADDI** **A. Fundamental skills** 1. Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line. 2. Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques. 2-3-2 System Chain Formation 3. Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense. 4. Game practice with application of Rules and Regulations. **B. Rules and their interpretations and duties of the officials.**	Total 32 Hrs 2 Hrs/Week
	Kho kho	**A. Fundamental skills** 1. Skills in Chasing: Sit on the box (Parallel & Bullet method), Get up from the box (Proximal & Distal method), Give Kho (Simple, Early, Late &Judgment), Pole Dive, Tapping, Hammering, Rectification of foul. 2.Skills in running: Chain Play, Ring play and Double and Single chain & Ring mixed play figure of 8-3 by 6. 3.Game practice with application of Rules and Regulations. **B. Rules and their interpretations and duties of the officials.**	

Semester	Course Title	Content	No. Hours
IV	**Athletics Track-** Sprints **Jumps-** Long Jump **Throws-** Shot Put	**Track Events** 1.1. Starting Techniques: Standing start and Crouch start (its variations) use of Starting Block. 1.2. Minimum Optimum and Maximum, Acceleration with proper running techniques. 1.3. Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. **Long Jump**: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick) and Landing **Shot put:** Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique	Total 32 Hrs 2 Hrs/Week
	Volley Ball	**A. Fundamental skills** 1. Service: Under arm service, Side arm service, Tennis service, Floating service. 2. Pass: Under arm pass, Over head pass. 3. Spiking and Blocking. 4. Game practice with application of Rules and Regulations **B. Rules and their interpretation and duties of officials.**	
	Throw Ball	**A. Fundamental skills:** Only Tennis Service, Air Service, two hand catching, one hand overhead return, side arm return. **Rules and their interpretations and duties of officials**	

Semester	Course Title	Content	No. Hours
V	**<u>Athletics</u> Track-** 110 &400 Mtrs Hurdles **Jumps-** High Jump **Throws-** Discuss Throw	**110 Mtrs and 400Mtrs:** Hurdling Technique :Lead leg Technique, Trail leg Technique ,Side Hurdling, Over the Hurdles Crouch start (its variations) use of Starting Block. Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. **High jump**: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. **Discus Throw**: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle).	Total 32 Hrs 2 Hrs/Week
	Foot Ball	**A. Fundamental Skills** 1. Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick. 2.Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot. 3.Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot. 4.Heading: In standing, running and jumping condition. 5.Throw-in: Standing throw-in and Running throw-in. 6.Feinting: With the lower limb and upper part of the body. 7.Tackling: Simple Tackling, Slide Tackling. 8.Goal Keeping: Collection of Ball, Ball clearance- kicking, throwing and deflecting. 9.Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials.**	
	Hockey	**A. Fundamental Skills** 1.Passing: Short pass, Long pass , push pass, Scooping hit 2.Trapping. 3.Dribbling and Dozing. 4.Penalty stroke practice. 5.Penalty corner practice. 6.Tackling: Simple Tackling, Slide Tackling. 7.Goal Keeping, Ball clearance- kicking, and deflecting. 8.Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials.**	

Semester	Course Title	Content	No. Hours
VI	**CRICKET**	**A. Fundamental Skills** **1.** Batting - Forward Defense Stroke, Backward Defense Stroke, Off Drive, On Drive, Straight Drive, Cover Drive, Square Cut. **2.** Bowling -Out-swing, In-swing, Off Break, Leg Break and Googly. **3.** Fielding: Catching - The High Catch, The Skim Catch, The Close Catch and throwing at the stumps from different angles. Long Barrier and Throw, Short Throw, Long Throw,Throwing on the Turn. **4.** Wicket Keeping **B. Rules and their interpretation and duties of officials**	Total 32 Hrs 2 Hrs/Week
	BASEBALL	A. **Fundamental Skills** Player Stances – walking, extending walking, L stance, cat stance Grip – standard grip, choke grip Batting – swing and bunt. Pitching Baseball : slider, fast pitch, curve ball, drop ball, rise ball, change up, knuckle ball, screw ball, **Rules and their interpretation and duties of officials.**	
	Athletics Combined Events- Heptathlon & Decathlon **Jumps**- Pole Vault **Throws**- Hammer Throw	Combined Events: Heptathlon all the 7 events Decathlon: All 10 Events **Pole Vault**: Approach Run, Planting the Pole,Take-off, Bar Clearance and Landing. **HammerThrow**: Holding the Hammer, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle).	

Semester	Course Title	Content	No. Hours
VII	**Basket ball**	**A. Fundamental Skills** 1.Passing: Two hand Chest Pass, Two hands Bounce Pass, One hand Baseball Pass, Side arm Pass, Overhead Pass, Hook Pass. 2.Receiving: Two hand receiving, One hand receiving, Receiving in stationary position, Receiving while Jumping and Receiving while Running. 3.Dribbling: How to start dribble, drop dribble, High Dribble, Low Dribble, Reverse Dribble, Rolling Dribble. 4.Shooting: Lay-up shot and its variations, One hand set shot, Two hands jump shot, Hook shot, Free Throw. 5.Rebounding: Defensive rebound and Offensive rebound. 6.Individual Defence: Guarding the player with the ball and without the ball, Pivoting. 7.Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials**	Total 32 Hrs 2 Hrs/Week
	Netball	**A. Fundamental skills** 1.Catching: one handed, two handed, with feet grounded and in flight. 2.Throwing (Different passes and their uses): One hand passes (shoulder, high shoulder, underarm, bounce, lob), two hand passes (Push, overhead and bounce). 3.Footwork: Landing on one foot, landing on two feet, Pivot, Running pass. 4. Shooting: One hand, forward step shot, and backward step shot. 5.Techniques of free dodge and sprint, sudden sprint, sprint and stop, sprinting with change at speed. 6. Defending: Marking the player, blocking, inside the circle, outside the circle. Defending the circle edge against the passing. 7. Intercepting: Pass and shot. 8. Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials**	

Semester	Course Title	Content	No. Hours
VIII	**Individual games** Shuttle Badminton	**A. Fundamental skills** 1.Basic Knowledge: Various parts of the Racket and Grip. 2.Service: Short service, Long service, Long-high service. 3.Shots: Over head shot, Defensive clear shot, Attacking clear shot, Drop shot, Net shot, Smash. 4.Game practice with application of Rules and Regulations. **B. Rules and their interpretations and duties of the officials.**	Total 32 Hrs 2 Hrs/Week
		A. Fundamental skills 1. Basic Knowledge: Various parts of the Racket and Grip (Shake Hand & Pen Hold Grip). 2. Stance: Alternate & Parallel. 3. Push and Service: Backhand & Forehand. 4. Chop: Backhand & Forehand. 5. Receive: Push and Chop with both Backhand & Forehand. 6. Game practice with application of Rules and Regulations. **B. Rules and their interpretations and duties of the officials**	
	Table Tennis	**A. Fundamental Skills** 1. Catching, Throwing and Ball control, 2. Goal Throws: Jump shot, Center shot, Dive shot, Reverse shot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack from two wings and center. 5. Blocking, GoalKeeping and Defensive skills. 6. Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials**	
	Handball	**A. Fundamental skills**1. Basic Knowledge: Basic Skills Service: Short service, Long service, Long-high service.3. Shots: Over head shot, Defensive clear shot, Attacking clear shot, Drop shot, Net shot, Smash.4. Game practice with application of Rules and Regulations. **B. Rules and their interpretation and duties of officials**	

REFERENCES

1. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
3. Petipus, et al. Athlete's Guide to Career Planning, Human Kinetics.
4. Dharma, P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, New Delhi.
5. Jain, R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
6. Vivek Thani, Coaching Cricket, Khel Sahitya Kendra, New Delhi.
7. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
8. Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
9. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
10. Dubey, H. C. Basketball, Discovery Publishing House, New Delhi.
11. Rachana Jain, Teach Yourself Basketball, Sports Publication.
12. Jack Nagle, Power Pattern Offences for Winning asketball, Parker Publishing Co., New York.
13. Renu Jain, Play and Learn Basketball, Khel Sahitya Kendra, New Delhi.
14. Sally Kus, Coaching Volleyball Successfully, Human Kinetics.
15. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani. 16 Bandopadhyay, K. Sarir Siksha Parichay, Classic Publishers, Kolkata
16. Test and Measurement (by Cleark and Cleark)
17. Evaluation in Physical Education (by Dr. Devendraya Kausal)
18. Methods of Physical Education (by Haridrash & Prof. Tirumalay Swamy)
19. Athletics (by Hardayal Singh)
20. Efficienting and Coaching (by Dr. Anand Nadigri)
21. Modern and Ancient History of Physical Education (by Dr. D. M. Jyothi)
22. Organization and Administration (by K. G. Nadigir or Vastrad)

YOGA AND MEDITATION

[As per Choice Based Credit System (CBCS) Scheme]
(From the academic year 2022-23)

Course Code	22YO39	CIE Marks	50
Credits	00	SEE Marks	00
Course Type	Practical		
Lecture Hours/Week (L-T-P)	0-0-2	Total Marks	50
Total Hours	28 Hours	SEE Hours	--

Semester	Content
III	1) Introduction of Yoga, Aim and Objectives of yoga, Prayer 2) Brief introduction of yogic practices for common man 3) Rules and regulations 4) Misconceptions of yoga 5) Suryanamaskara 6) Different types of Asanas a. Sitting b. Standing c. Prone line d. Supine line
IV	1) Patanjali's Ashtanga Yoga 2) Suryanamaskara 3) Different types of Asanas a. Sitting b. Standing c. Prone line d. Supine line 4) Kapalbhati 5) Pranayama
V	1) Patanjali's Ashtanga Yoga 2) Suryanamaskara 3) Different types of Asanas a. Sitting b. Standing c.Prone line d.Supine line 4) Kapalbhati 5) Pranayama

VI	1) Patanjali's Ashtanga Yoga 2) Suryanamaskara 3) Different types of Asanas a.Sitting b.Standing c.Prone line d.Supine line 4) Kapalbhati 5) Pranayama
VII	1) Patanjali's Ashtanga Yoga 2) Suryanamaskara 3) Different types of Asanas a.Sitting b.Standing c. Prone line d. Supine line 4) Kapalbhati 5) Pranayama
VIII	1) Patanjali's Ashtanga Yoga 2) Suryanamaskara 3) Different types of Asanas a. Sitting b. Standing c. Prone line d. Supine line 4) Kapalbhati 5) Pranayama 6) Shat Kriyas

Notes:

- One Hour of Lecture is equal to 1 Credit
- One Hour of Tutorial is equal to 1 Credit (Except Languages)
- Two Hours of Practical is equal to 1 Credit
- SEE : Semester End Examination
- CIE : Continuous Internal Examination
- L+T+P : Lecture + Tutorial + Practical

Guidelines

Semester	Course Title	Content	No. of Hours
3rd Semester	Introduction of Yoga, Aim and Objectives of yoga, Prayer	Yoga, its origin, history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer	Total 32 hrs 2 hrs / week
	Brief introduction of yogic practices for common man	Yogic practices for common man to promote positive health	
	Rules and regulations	Rules to be followed during yogic practices by practitioner	
	Misconceptions of yoga	Yoga its misconceptions, Difference between yogic and non yogic practices	
	Suryanamaskara	Suryanamaskar prayer and its meaning, Need, importance and benefits of Suryanamaskar 12 count, 2 rounds	
	Different types of Asanas e. Sitting 1. Padmasana 2. Vajrasana f. Standing 1. Vrikshana 2. Trikonasana g. Prone line 1. Bhujangasana 2. Shalabhasana h. Supine line 1. Utthita dvipadasana 2. Ardha halasana	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana	
4th Semester	Patanjali's Ashtanga Yoga 1. Yama 2. Niyama	Patanjali's Ashtanga Yoga its need and importance. Yama :Ahimsa, satya, asteya, brahmacarya, aparigraha Niyama : shoucha, santosh, tapa, svaadhyaya, Eshvara pranidhan	Total 32 hrs 2 hrs / week
	Suryanamaskara	Suryanamaskar 12 count 4 rounds	
	Different types of Asanas e. Sitting 1. Sukhasana 2. Paschimottanasana f. Standing 1. Ardhakati Chakrasana 2. Parshva Chakrasana g. Prone line 1. Dhanurasana h. Supine line 1. Halasana 2. Karna Peedasana	Asana, Need, importance of Asana. Different types of asana. Asana its meaning by name, technique, precautionary measures and benefits of each asana	
	Kapalabhati	Meaning, importance and benefits of Kapalabhati. 40 strokes/min 3 rounds	
	Pranayama – 1. Suryanuloma –Viloma 2. Chandranuloma-Viloma 3. Suryabhedana 4. Chandra Bhedana 5. Nadishodhana	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama	

5th Semester	Ashtanga Yoga 3. Asana 4. Pranayama	Patanjali's Ashtanga Yoga its need and importance.	Total 32 hrs 2 hrs / week
	Suryanamaskara	Suryanamaskar 12 count 6 rounds	
	Different types of Asanas a. Sitting 1. Ardha Ushtrasana 2. Vakrasana b. Standing 1. Urdhva Hastothanasana 2. Hastapadasana c. Prone line 1. Padangushtha Dhanurasana d. Supine line 1. Sarvangasana 2. Chakraasana	Asana, Need, importance of Asana. Different types. Asana its meaning by name, technique, precautionary measures and benefits of each asana	
	Kapalabhati	Revision of practice 50 strokes/min 3 rounds	
	Pranayama – 1. Surya Bhedana 2. Ujjayi	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama	
6th Semester	Ashtanga Yoga 5. Pratyahara 6. Dharana	Patanjali's Ashtanga Yoga its need and importance.	Total 32 hrs 2 hrs / week
	Suryanamaskara	Revision of practice 12 count 8 rounds	
	Different types of Asanas a. Sitting 1. Aakarna Dhanurasana 2. Yogamudra in Padmasana b. Standing 1. Parivritta Trikonasana 2. Utkatasana c. Prone line 1. Poorna Bhujangasana / Rajakapotasana d. Supine line 1. Navasana/Noukasana 2. Pavanamuktasana	Asana, Need, importance of Asana. Different types, Asana by name, technique, precautionary measures and benefits of each asana	
	Kapalabhati	Revision of practice 60 strokes/min 3 rounds	
	Pranayama – 1. Sheetali 2. Sheektari	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama	
7th Semester	Ashtanga Yoga 1. Dhyana (Meditation) 2. Samadhi	Patanjali's Ashtanga Yoga its need and importance.	Total 32 hrs 2 hrs / week
	Suryanamaskara	Revision of practice 12 count 10 rounds	
	Different types of Asanas a. Sitting 1. Vibhakta Paschimottanasana 2. Yogamudra in Vajrasana b. Standing 1. Parshvakonasana 2. Ekapadbaddhapadmottanasana c. Prone line balancing 1. Mayurasana d. Supine line 1. Sarvangasana 2. Setubandhasana 3. Shavasanaa (Relaxation poisture)	Asana, Need, importance of Asana. Different types, Asana by name, technique, precautionary measures and benefits of each asana	
	Kapalabhati	Revision of practice 80 strokes/min 3 rounds	

	Pranayama – 1. Bhastrika 2. Bhramari	Meaning, Need, importance of Pranayama. Different types. Meaning by name, technique, precautionary measures and benefits of each Pranayama	
8th Semester	Suryanamaskara	Revision of practice 12 count 12 rounds	Total 32 hrs 2 hrs / week
	Different types of Asanas a. Sitting 1. Bakasana 2. Hanumanasana 3. Ekapada Rajakapotasana b. Standing 1. Vatayanasana 2. Garudasana 3. Natarajasana c. Balancing 1. Sheershasana d. Supine line 1. Setubandha Sarvangasana 2. Shavasanaa (Relaxation poisture)	Asana, Need, importance of Asana. Different types, Asana by name, technique, precautionary measures and benefits of each asana	
	Kapalabhati	Revision of practice 100 strokes / min, 3 rounds	
	Pranayama – 1. Nadishodhana 2. Ujjai 3. Bhramari	Revision of practices	
	Shat Kriyas 1. Jalaneti & sutraneti 2. Nouli (only for men) 3. Sheetkarma Kapalabhati	Meaning, Need, importance of Shatkriya. Different types. Meaning by name, technique, precautionary measures and benefits of each Kriya	

Book for Reference:

·Swami Kuvulyananda : Asma (Kavalyadhama, Lonavala)
·Tiwari, O P : Asana Why and How
·Ajitkumar : Yoga Pravesha (Kannada)
·Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
·Swami Satyananda Saraswati : Surya Namaskar (Bihar School of yoga, Munger)
·Nagendra H R : The art and science of Pranayama
·Tiruka : Shatkriyegalu (Kannada)
·Iyengar B K S : Yoga Pradipika (Kannada)
·Iyengar B K S : Light on Yoga (English)