SCHEME OF EXAMINATION
B.Tech. (PIE) 3rd Semester

CODE	COURSE	L	T	P	Credits
PIPC201	**Thermodynamics**	**3**	**0**	**0**	**3**
PIPC202	**Fluid Mechanics and Machines**	**3**	**0**	**0**	**3**
PIPC203	**Facilities Design**	**3**	**0**	**0**	**3**
PIPC204	**Theory of Machines**	**3**	**0**	**0**	**3**
****IC*****	**Machine learning and Data Analytics**	**3**	**0**	**2**	**4**
PIPC205	**Production Technology-I**	**3**	**0**	**0**	**3**
PIPC206	**Production Technology-I (P)**	**0**	**0**	**2**	**1**
PIPC207	**Fluid Mechanics and Machines (P)**	**0**	**0**	**2**	**1**
PIPC208	**Theory of Machines (P)**	**0**	**0**	**2**	**1**
SWNC101	**NCC/Sports/Yoga**	**0**	**0**	**2**	**1***
SWNC102	**NSS/Clubs/Technical Societies**	**0**	**0**	**2**	**1***
	Total Credits				**22**

***** *Continuous Evaluation Model as per guidelines and the credit to be awarded at the end of 6th Semester based on Cumulative performance up to 6th Semester*

SCHEME OF EXAMINATION
B. Tech. (PIE) 4th Semester

CODE	COURSE	L	T	P	Credits
PIPC209	Production Technology-II	3	0	0	3
PIPC210	Operations Research	3	0	0	3
PIPC211	Strength of Materials	3	0	0	3
PIPC212	Heat Transfer	3	0	0	3
PIPC213**	Machine Drawing	1	0	5	3
PIPC214	Value Engineering	3	0	0	3
PIPC215	Materials Science	3	0	0	3
PIPC216	Production Technology-II (P)	0	0	2	1
PIPC217	Strength of Materials (P)	0	0	2	1
SWNC101	NCC/Sports/Yoga	0	0	2	1*
SWNC102	NSS/Clubs/Technical Societies	0	0	2	1*
	Total Credits				23

***** *Continuous Evaluation Model as per guidelines and the credit to be awarded at the end of 6th Semester based on Cumulative performance up to 6th Semester*

PIPC201: THERMODYNAMICS

Pre-requisite: NIL

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief description about the course

UNIT- I

Introduction: Definition, Classical and statistical thermodynamics; Macroscopic and microscopic approaches, thermodynamic system, state, boundary, surroundings; thermodynamic properties, process and cycle; thermal and thermodynamic equilibrium, Quasi-static process, continuum concept, zeroth law of thermodynamics.

Temperature: Measurement of temperature-reference points; Gas thermometers and their comparison, Ideal gas temperature, Celsius temperature scale, thermocouple.

(9 hrs)

UNIT- II

Work and Heat Transfer: Work transfer, PdV work, other types of work transfer, Free expansion, Heat Transfer, Specific heat, Latent heat.

First Law of Thermodynamics for the close systems: First Law for a closed system undergoing cycle, First Law for a closed system undergoing a change of state, Specific heat at constant volume, Enthalpy, Specific heat at constant pressure, Energy of an isolated system, PMM-I

First Law of Thermodynamics for the open systems: Control volume concept, Steady flow energy equation and its application to turbines, pumps, compressors, boilers, condensers, nozzles etc.

(**10 hrs)**

UNIT- III

Second Law of Thermodynamics: Limitations of the First Law, Heat source & sink, Heat engine, Refrigerator & Heat Pump, The Second Law, Kelvin Planck and Clausius statements; Reversible & Irreversible processes; Carnot theorem, reversed heat engines.

Entropy: Clausius theorem, Inequality of Clausius, Entropy Principle and its applications, Entropy transfer with heat flow, Entropy generation in open & closed systems, Reversible adiabatic work in a steady flow system, Third law of thermodynamics. **(9 hrs)**

UNIT- IV

Properties of Gases: Avogadro's law, equation of state of a gas, internal energy of an ideal gas, heat capacity relations, entropy change of an ideal gas, heat, work and entropy transfer relations for reversible adiabatic process, isothermal and poly-tropic processes, Joule kelvin effect.

Properties of Pure Substances: P-v, P-T, T-S diagrams for a pure substance (water), Tables of properties, Molliar Diagram and Steam tables, dryness fraction and measurement of steam quality. Apply the concepts of thermodynamics in basic power cycles, refrigeration cycles and understand their sustainable development. **(12 hrs)**

NOTE:

The focus of concluding lectures should be to emphasize the value addition of the subject and also on how it impacts the environment. Further, the faculty may suggest possible sustainable solutions/emerging technologies/innovations towards sustainability in the subject domain.

Reference Books:

1. P.K. Nag, Engineering Thermodynamics, TMH.
2. M. Achuthan, Engineering Thermodynamics, TMH.
3. Cengel and Boles, Thermodynamics: An Engineering Approach, McGraw Hill.

Course Outcomes

CO1: Understand the basic concepts of thermodynamics such as heat, work, state etc.

CO2: Identify the properties of substances on property diagrams and obtain the data from property tables.

CO3: Evaluate Apply First Law of Thermodynamics to open and closed systems.

CO4: Apply the Second Law of Thermodynamics and the concept of entropy to analyse the thermal efficiencies of heat engines.

PIPC202: FLUID MECHANICS AND MACHINES

Pre-requisite: NIL

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief description about the course

The course on Fluid Machines and Machines holds immense significance in various engineering domains due to its broad scope. It focuses on the fundamental principles of fluid mechanics that govern energy transfer within fluid machines. Additionally, it covers a comprehensive overview of hydraulic and air machines, including their performances. The course offers a well-rounded approach, incorporating physical concepts, mathematical operations, and practical examples and exercises. By the end of the course, students will have developed a solid understanding of Fluid Mechanics and Machines, enabling them to effectively apply the fundamental principles, laws, and relevant equations in engineering machine design for specific applications.

UNIT I

Definition of Fluid, properties of fluid, Fluid Statics: Fluid pressure, Pascal's law, general equation of fluid statics, pressure head of a fluid, simple and differential manometers, Metacentric height, Buoyancy, Stability. **(10 hrs)**

UNIT II

Lagrangian and Eulerian methods, Reynold Transport Theorem, types of flow, velocity and acceleration, continuity equation, stream function, velocity potential function, flow nets, types of motion: linear translation, linear deformation, angular deformation and rotation. Fluid Dynamics: Euler's equation, Bernoulli's equation, energy equation, practical applications of Bernoulli's equation in venturimeter, orifice meter and pitot tube**.** **(10 hrs)**

UNIT III

Impact of jet on stationary and moving flat and curved plates, forces on series of vanes, radial vanes. Hydraulic Turbines: Introduction, development of hydraulic turbines, classification of turbines. Turbines: Pelton, Francis, Propeller, Kaplan; working and essential components of these turbines. **(10 hrs)**

UNIT IV

Centrifugal pumps: working and its various components, classification, losses and efficiencies. Reciprocating pumps: working and its various components, classification, comparison with centrifugal pumps. Case studies/Latest developments/Sustainable technologies in Fluid Mechanics and Machines **(10 hrs)**

NOTE:

The focus of concluding lectures should be to emphasize the value addition of the subject and also on how it impacts the environment. Further, the faculty may suggest possible sustainable solutions/emerging technologies/innovations towards sustainability in the subject domain.

Text Books/References

1. Fox, McDonald and Pritchard, Fluid Mechanics, Wiley, 8th Edition, 2013.
2. Yunus A. Cengel and John M. Cimbala, Fluid Mechanics: Fundamentals and Applications, McGraw Hill-Education, 3rd Edition, 2014.
3. S. K. Som, G. Biswas and S. Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, McGraw Hill-Education, 3rd Edition.

Course Outcomes

CO1: Apply the principle of fluid statics in pressure measurements.

CO2: Apply the principles of continuity, momentum, and energy in engineering applications.

CO3: Apply the basic principles, the conservation laws, and the pertinent equations to engineering design of hydraulic turbines.

CO4: Apply the basic principles, the conservation laws, and the pertinent equations to engineering design of the hydraulic pumps.

PIPC203: FACILITIES DESIGN

Pre-requisite: Nil

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief Description about the course

Facility design and planning is to understand the main concepts of Plant Location and apply them to know about the practical aspects of Industrial World. The learning objectives of this course are: to understand the main concepts and application of Facility Design for Manufacturing System. This course helps students to learn about the main fundamentals of Plant Layout. Facility design and planning impart thorough knowledge to the students regarding Facility Planning, Material Handling Systems and Equipment.

UNIT-I

Plant Location: Nature of Location Decision, need for facility location planning, General procedures and actors influencing location decisions, Facility Location Models, economics and cost analysis, Rural and urban location pattern in India.

Plant Layout: Introduction of production system, scope, objectives, importance, and types of plant layout, characteristics of a good plant layout, factoring affecting plant layout, procedure of developing a plant layout, installation and evaluation of plant layout, optimum plant layout.

(12 hrs)

UNIT-II

Facility Planning: Definition, Significance and objectives of facility planning, Facility planning process, Strategic Facilities Planning, Developing Facilities Planning Strategies, Flow system patterns like RAFT, CORELAP, ALDEP & PLANET, Material flow system, Activity Relationships, Space requirements, Basic Lay out types, Lay out procedures, Algorithmic Approaches, Department Shapes and mail Aisles, The impact of changes, developing Layout Alternatives.

(10 hrs)

UNIT- III

Facility Design For Manufacturing System: Introduction, Fixed Automation System, Flexible manufacturing system, Reduction in work in process, Just-in-time manufacturing, Facilities planning trends. **(6 hrs)**

UNIT- IV

Material Handling & Equipment: Definition, scope, objectives, principles, importance, factors in materials handling problem, analysis of materials handling, types and selection of materials handling equipment's, aids and techniques in materials handling equipment selection. Planning of material flow, advantages of planned material flow, flow planning principles, flow patterns, analysis of material flow. Material Handling Equipment: Selection of material handling systems and equipment: Automated Guided Vehicles, types, features, usage. Conveyors: basic functionality requirements, types of Conveyors, application considerations, operational considerations. Cranes, hoists and industrial trucks. **(12 hrs)**

NOTE:

The focus of concluding lectures should be to emphasize the value addition of the subject and also on how it impacts the environment. Further, the faculty may suggest possible sustainable solutions/emerging technologies/innovations towards sustainability in the subject domain.

Text Books / Reference Books

1. JamesA.Tompkins.,“Facilities Planning”.Edition 3, publisher J.Wiley 2003.
2. S.N.Chary., “Production and Operations Management” Publisher Tata McGraw-Hill Education 2004.
3. James Apple, "Plant Layout & Material Handling", The Ronalt Press Co., New Delhi, 1998.
4. Meyers, F.E., and Stephens, M.P., “Manufacturing Facilities Design and Material Handling”, Prentice-Hall, Inc. 2000.
5. Francis, McGinnis and White,”Facilities Layout & Location an Analytical Approach”, Prentice Hall of India Pvt Ltd.
6. Meyers, F.E., and Stephens, M.P., “Manufacturing Facilities Design and Material Handling”, Prentice-Hall, Inc., 2000.

Course Outcomes

CO1: The students will be able to understand Rural and Urban location pattern in India.

CO2: The students will be able to understand Developing Facilities Planning Strategies.

CO3: The students will be able to identify and analyse the problems in the existing layout/ material handling system and shall be able to optimize the layout/material handling system.

CO4: The students will be able to understand the various material handling equipment Facilities Planning.

PIPC204: THEORY OF MACHINES

Pre-requisite: Nil

L	T	P	Credits	Total contact hours
3	-	-	3	40

Brief Description about the Course

Theory of machines & mechanisms focuses on the study of relative motion between numerous machine components and the forces acting on them. The overall objective of this course is to learn how to analyze the motions of mechanisms, design mechanisms to have desired motions, and analyze forces on machines. It is the combination of the Kinematics and Dynamics of Machines. Kinematics of machines deals with the study of position, displacement, velocity and acceleration of machine parts. Dynamics of machines involves the study of forces acting on the machine parts and the motions resulting from these forces. To study various machine components as clutches & brakes, gear & gear trains, flywheel, belts & ropes and governors.

UNIT-I

Mechanisms and Machines: Kinematics, Dynamics: Introduction to analysis and synthesis of Mechanisms, Links, pairs, Degree of freedom in Machines and Mechanisms.

Velocity and Accelerations Analysis: Velocity determination: Relative velocity method, Instantaneous centre method Kennedy theorem. Acceleration determination by graphical method, Coriolis component of acceleration. **(10 hrs)**

UNIT- II

Type of Clutches: Plate and Cone Clutches: Type of Brakes: external shoe brakes, band & block brakes, internal expending shoe brakes.

Gear and Gear Trains: Types of gears, gear terminology, condition for correct gearing, cycloidal and involute profiles of gear teeth, pressure angle, path of contact, arc of contact, interference, minimum number of teeth to avoid interference. Simple, compound, reverted and epicyclic gear trains and their solution. **(10 hrs)**

UNIT- III

Flywheel: Turning moment diagram for single cylinder and multi-cylinder engines, coefficient of fluctuation of energy, coefficient of fluctuation of speed flywheel and its function.

Belts & Ropes: Open and crossed belt drives, velocity ratio, slip & creep, material for belts, length of belt, tensions, centrifugal tension, power transmitted by belts and ropes, initial tension.

(10 hrs)

UNIT-IV

Governors: Type of Governors, Watt, porter, proell, spring loaded centrifugal, inertia. Sensitiveness, stability, isochronism, hunting, effort and power of governor. Automotive transmission gear trains, Introduction to continuous variable transmission (CVTs), Types of CVTs. **(10 hrs)**

NOTE:

The focus of concluding lectures should be to emphasize the value addition of the subject and also on how it impacts the environment. Further, the faculty may suggest possible sustainable solutions/emerging technologies/innovations towards sustainability in the subject domain.

Text Books/References:

1. Theory of Machines by S.S Rattan, Tata McGraw Hill
2. Theory of Machine by V P Singh, Dhanpat Rai Publishing Co.
3. Theory of Machines by Thomas Beven, CBS Publishers
4. Theory of Machines by Sadhu Singh, Pearson Publisher
5. Mechanism and Machine Theory by J S Rao & R V Dukipatti, New Age International

Course outcomes:

CO1 Understand the common mechanisms and machines
CO2 Perform velocity and acceleration analysis of mechanisms
CO3 Perform dynamic analysis of machines
CO4 Describe the working of different types of clutches & brakes
CO5 Understand important gear trains and their practical applications.

PIPC205: PRODUCTION TECHNOLOGY-I

Pre-requisite: **Engineering Practice, Manufacturing Processes**

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief Description about the course:

To introduce metal cutting and related aspects, various material removal processes.

UNIT I

Metal Cutting: Concept of generatrix and directrix; Classification of machining processes: Orthogonal and oblique, machining, single point and multi-point machining; Tool geometry: Single point cutting tool geometry, selection of tool angles; Cutting tool materials, Chip formation: Mechanism, chip types, chip control; Mechanics of single point orthogonal machining: Merchant's circle, force, velocity, shear angle, and power consumption relations, specific energy

Thermal Aspects of Machining: Cutting temperature and factors affecting it, measurement, cutting fluids and its types, selection of cutting fluids.

(10 hrs)

UNIT II

Cutting Tool Wear and Life: Wear Mechanism, wear criterion, Taylor's tool life equation, flank wear, crater wear, variable affecting tool life, machinability and its measures.

Economics of metal machining: Elements of machining cost, machining economics and optimization for single pass turning operation.

(10 hrs)

UNIT III

Hole Making Operations: Introduction, drilling, reaming, boring, tapping, other hole making operations.

Reciprocating Machine Tools: Construction and working of shaper, planer, and slotter, quick-return mechanism, job holding devices.

(10 hrs)

UNIT IV

Milling: Introduction, milling machines types, milling cutters, milling operations, dividing head and indexing types, Up milling down milling, milling operations, special set-ups.

Analysis of Machining Processes: Mechanics of machining of turning, boring, shaping and planning, milling (Slab and face milling), drilling, machining time calculations of above operations.

(10 hrs)

NOTE:

The focus of concluding lectures should be to emphasize the value addition of the subject and also on how it impacts the environment. Further, the faculty may suggest possible sustainable solutions/emerging technologies/innovations towards sustainability in the subject domain.

Text Books / Reference

1. Boothroyed, G. et al., Fundamentals of Metal Cutting and Machine Tools, McGraw Hill.
2. DeGarmo, E. P., Black, J.T., and Kohser, R.A., “Materials and Processes in Manufacturing”, Prentice-Hall of India.
3. Kalpakjian, S., and Schmid, S.R., “Manufacturing Engineering and Technology”, Pearson Education.
4. Groover, M.P., “Fundamentals of Modern Manufacturing”, John Wiley & Sons.Manufacturing Science - Ghosh and Mallik, E.W. Press
5. Rao,P.N., “Manufacturing Technology”, (Vol. 2), Tata McGraw-Hill
6. Ghosh, A. and Mallik, M., “Manufacturing Science”, E.W. Press
7. Production Engineering Science- Pandey and Singh

Course Outcomes

CO1: To understand metal cutting and related aspects

CO2: To understand tool wear, tool life and economics of machining principles

CO3: To understand various hole making operations and reciprocating machines tools

CO4: To understand milling process as well as application of metal cutting principles to practical machining operations

PIPC206: PRODUCTION TECHNOLOGY-I (P)

Pre-requisite: **Engineering Practice**

L	T	P	Credits	Total contact hours
0	0	2	1	14

Brief Description about the course:

To provide hands on training by preparing various jobs in workshop

List of Experiments

1. To measure various angles of a single point cutting tool
2. To measure various angles of a milling cutter
3. To Prepare a job on a lathe having various operations viz. drilling, boring, taper turning, thread cutting, knurling, etc.
4. To prepare a given job on milling machine
5. Introduction to shaper and demonstration of quick return mechanism
6. Introduction to tool grinder
7. introduction to tool dynamometer
8. Prepare a wooden pattern of the given item considering allowances etc.
9. Prepare a mould and do casting of the pattern (Sl. No.8) prepared above.
10. To carry out welding by electric arc welding in flat, horizontal and vertical position of given jobs

Course Outcomes:

The students will be able to measure various tool angles, carry out various operations on lathe and milling machine, as well as welding of jobs

PIPC207: FLUID MECHANICS AND MACHINES (P)

Pre-requisite: Nil

L	T	P	Credits	Total contact hours
0	0	2	1	24

Brief Description about the course

This course is about proving hands on training to students about the physical principles of Fluid Mechanics and Machines. The course will enable students to effectively communicate ideas and concepts through written work, class discussions and laboratory reports.

Course Contents:

1. To verify the Bernoulli's theorem.
2. To determine coefficient of discharge for an Orifice meter.
3. To determine coefficient of discharge of a venturimeter.
4. To calibrate a given notch.
5. To determine coefficient of discharge for a mouth piece.
6. To determine the Darcy Weisbach Coefficient of friction for flow through commercial
7. pipes.
8. To determine critical Reynolds' numbers for flow through commercial pipes.
9. To study the momentum characteristics of a given jet.
10. Study and perform test on a Torque Convertor.
11. Study and perform test on a Hydraulic Ram to find out its efficiency.
12. Determine the overall efficiency of Pelton wheel Turbine at constant speed and constant head.
13. Determine the overall efficiency of Francis Turbine at constant speed and constant head.

Course Outcomes

CO1: Understand the principles of fluid flow using experiments.

CO2: Measure the flow properties in a fluid flow such as: velocity, discharge, pressure, frictional losses etc.

CO3: Apply the principles of fluid mechanics in design.

CO4: Demonstrate the ability to prepare lab report.

PIPC208: THEORY OF MACHINES (P)

Pre-requisite: Nil

L	T	P	Credits	Total contact hours
-	-	2	1	24

Brief Description about the Course

Theory of Machine lab may be defined as that branch of engineering science that deals with the study of relative motion between various parts of a machine and forces that act on them. The main objective of this lab is to impart knowledge on design and analysis of mechanisms for the specified type of motion in a machine. To perform kinematic & dynamic analysis of various mechanisms & machines and performance of various power/torque transmission equipment are the goals of this course.

List of Experiments:

1. To study and draw all inversions of four bar chain, single & double slider crank mechanisms.
2. To determine experimentally the ratio of cutting to idle time to the crank & slotted lever (QRM) & compare the result with theoretical values. Plot the following:
   - θ v/s displacement of slider
   - θ v/s velocity
   - θ v/s acceleration
3. To determine velocity & acceleration of slider in Slider Crank mechanism and plot the following:
   - θ v/s displacement of slider
   - θ v/s velocity
   - θ v/s acceleration & compare the values of velocities and acceleration with those obtained theoretically. Assume angular velocity = 1 rad/sec
4. To determine the values of coefficient of friction between the screw & nut of jack while:
   - Raising the load
   - Lowering the load
5. To determine the value of coefficient of friction between belt & pulley and plot a graph between log T_1/T_2, & θ and measure the slip and creep in belt drive.
6. To draw velocity and acceleration polygons of all moving link joints in slider crank mechanism.
7. To calculate the Moment of Inertia of a flywheel about its of rotation.
8. To find the velocity ratio, mechanical advantage and efficiency of a simple screw jack.
9. To study different types of Centrifugal governors.
10. To study various types of Gears and their terminologies – Spur, Helical, Worm and Bevel Gear. To study various types of gear trains: simple, compound, reverted & epicyclic.
11. To Plot the characteristic curves for Porter and Proell governors. To perform the effect of varying the mass of central sleeve for Porter and Proell governors.
12. To measure Epicyclic Gear ratio between input shaft and output shaft

Course outcomes:

CO1: Understand the methodology of measurements of various kinematic parameters of machine elements.

CO2: Understand, analyze and verify the principle involved in working of machine elements.

CO3: To understand & illustrate various power transmission mechanisms.

CO4: Knowledge of Governors and Gears.

Evaluation criterion for NCC Cadets

Following criterion is proposed to be adopted for the evaluation of NCC cadets for the practical course of NCC/NSS/Yoga

A: Internal Evaluation (During semester):

(i) Attendance:	20 marks (for 90 % attendance full marks)
(ii) Discipline:	10 Marks
(iii) Drill performance & Body bearing:	10 marks
(iv) Participation in social activities:	10 marks
(v) Domain knowledge:	10 marks (Through oral viva)

B: End sem evaluation: (At the end of the semester)

(i) Discipline:	10 Marks
(ii) Drill performance & Body bearing:	15 marks
(iv) Domain knowledge:	15 marks (Through oral viva)

C: After end of the 6^{th} semester: Bonus marks 10 for each B & C certificate is proposed to be added in final marks subject to total marks does not exceed 100

NATIONAL CADET CORPS

INSTITUTIONAL TRAINING SYLLABUS

INTRODUCTION

1. Institutional Training being conducted in the Colleges and Schools is the principal means of training in the NCC. The aim of the training is to nurture core values, enhance awareness and give exposure to basic military skills and knowledge. Emphasis will be on practical training. Case studies, wherever possible will be used to facilitate active participation and better assimilation. Examples from India's freedom struggle and wars fought by India, post-independence, should supplement relevant subjects to generate secular and patriotic fervor. The instructors and the cadets must grasp the importance of this training and participate actively.

2. **Principles of Training:** In keeping with the changing environment, the principles of NCC Training are:
   (a) Junior Division (JD)/Junior Wing (JW) to be for two years while Senior Division (SD)/Senior Wing (SW) will be for three years.
   (b) Separate syllabi for JD/JW and SD/SW.
   (c) Modified, syllabus for professional educational institutes of repute to encourage enrolment of cadets.
   (d) Revised curriculum for training in a military environment with greater emphasis on soft skill development, awareness of social responsibilities and adventure and sports.
   (e) Uniformity in syllabus for boys and girls.
   (f) Common syllabus for all three wings to be approximately 60 to 70% and Specialised Service Syllabus training will be 30 to 40%.
   (g) Emphasis on practical training.
   (h) Conduct of periodic composite training ensuring continuity for better learning assimilation and its application.

3. Common subjects will comprise about 70% of the periods and Specilalised Service Subjects will be 30%. The breakdown of periods are as under:-

Sr. No.	Subject	No. of Periods			
		First Year	Second Year	Third Year	Total
Senior Division/Wing					
(a)	Common Subject	66	72	72	210
(b)	Specilised Subject	24	33	33	90
	Total	**90**	**105**	**105**	**300**

Junior Division/Wing

(c)	Common Subject	85	85		170
				--NA—	
(d)	Specialised Subject	35	35		70
	Total	**120**	**120**		**240**

4. In addition to this syllabus, **State Directorates** will conduct Social Service Activities in the form of rallies of any nature to carry social messages in the form of posters, street plays, placards etc.

Legend	
Abbreviation	Type
L	Lecture
D	Demonstration
DI	Discussion
P	Practice
V	Video

BLOCK SYLLABUS

COMMON SUBJECTS: SD/SW (ALL WINGS)

Sr. No.	Subject	1st Year	2nd Year	3rd Year	Total Periods
1.	The NCC	03	00	00	03
2.	National Integration and Awareness	06	06	06	18
3.	Drill	16	19	08	43
4.	Weapon Training	12	10	10	32
5.	Personality Development & Leadership	10	15	20	45
6.	Disaster Management	03	03	04	10
7.	Social Awareness & Community Development	05	05	06	16
8.	Health & Hygiene	05	04	07	16
9.	Adventure	02	06	07	15
10.	Environment Awareness and Conservation	02	02	02	06
11.	Obstacle Training	02	02	02	06
Total		**66**	**72**	**72**	**210**

BLOCK SYLLABUS

SPECIALISED SUBJECTS: SD/SW (ARMY)

Sr. No.	Subject	1st Year	2nd Year	3rd Year	Total Periods
1.	Armed Forces	04	04	02	10
2.	Map Reading	07	08	09	24
3.	Field Craft & Battle Craft	05	07	09	21
4.	Introduction to infantry Weapons & Equipment	02	04	05	11
5.	Military History	03	05	05	13
6.	Communication	03	05	03	11
Total		**24**	**33**	**33**	**90**

BLOCK SYLLABUS

SPECIALISED SUBJECTS: SD/SW (AIR)

Sr. No.	Subject	1st Year	2nd Year	3rd Year	Total Periods
1.	General Service Knowledge	02	02	02	06
2.	Air Compaigns	00	02	04	06
3.	Aircraft Recognition	00	04	00	04
4.	Modern Trends	00	00	02	02
5.	Principles of Flight	03	04	03	10
6.	Airmanship	06	02	02	10
7.	Navigation	00	03	02	05
8.	Meteorology	00	01	04	05
9.	Aero-Engines	01	04	01	06
10.	Airframes	02	02	02	06
11.	Instruments	02	03	02	07
12.	Aircraft Particulars	02	00	00	02
13.	Aeromodelling	06	06	09	21
Total		**24**	**33**	**33**	**90**

BLOCK SYLLABUS

SPECIALISED SUBJECTS: SD/SW (NAVY)

Sr. No.	Subject	1st Year	2nd Year	3rd Year	Total Periods
1.	Naval Orientation	08	06	03	17
2.	Naval Warfare and its Components	00	04	03	07
3.	Naval Communication	03	04	01	08
4.	Navigation	00	06	03	09
5.	Searmanship				
	(a) Anchor Work	01	01	00	02
	(b) Rigging	03	00	00	03
	(c) Boat Work	04	05	01	10
6.	Fire Fighting, Flodding and Damage Control	00	02	02	04
7.	Ship and Boat Modelling	02	03	14	19
8.	Search and Rescue	01	00	01	02
9.	Swimming	01	03	05	09
Total		**24**	**33**	**33**	**90**

Syllabus and Evaluation Scheme of Physical Education & Sports
Compulsory for up to B.Tech 6th Semester Students

Course Code: SWNC101	**L**	**T/P**	**C**
Course Title: Sports	**0**	**4**	**2**

Course Objective

Physical Education and Sports develop confidence, contributing to academic performance and mental health. Physical activity is a great way to relieve stress, promoting positive physical and mental health and enhanced learning aptitude. The class duration of 90 minutes will be divided into 02 segments comprising of Units 1 and 2.

- First 30 minutes of the class will be an interactive session where the students will be oriented and introduced to the different aspects of Physical Education and Sports.
- In the next 60 minutes of the class every students shall practice different skills and techniques of Athletics comprising of Track and Field events or any other specific games/sports of their choice.

Syllabus

Unit 1

Introduction to Physical Education

- Meaning & definition of Physical Education
- Aims & Objectives of Physical Education

Sports awards and honours

- Awards and Honours in the field of Sports in India (Dronacharya Award, Arjuna Award, Dhayanchand Award, Rajiv Gandhi Khel Ratna Award etc.)

Olympic Movement

- Ancient & Modern Olympics (Summer & Winter)
- Olympic Symbols, Ideals, Objectives & Values

Physical Fitness, Wellness & Lifestyle

- Meaning & Importance of Physical Fitness
- Components of Physical fitness
- Components of Health related fitness Meaning & Importance of Wellness, Components of wellness
- Preventing Health Threats through Lifestyle Change
- Concept of Positive Lifestyle: Importance of Balance Diet etc.

Fundamentals of Anatomy & Physiology in Physical Education and Sports

- Define Anatomy, Physiology & Its Importance
- Effect of exercise on the functioning of Various Body Systems. (Circulatory System, Respiratory System, Neuro-Muscular System etc.)

Kinesiology, Biomechanics & Sports

- Meaning & Importance of Kinesiology & Biomechanics in Physical Edu. & Sports
- Biomechanical principles & its application in sports. (Laws of motion, Friction, Projectile etc.)

Postures

- Meaning and Concept of Postures.
- Causes of Bad Posture.
- Advantages & disadvantages of weight training.
- Concept & advantages of Correct Posture. Common Postural Deformities – Knock Knee; Flat Foot; Round Shoulders; Lordosis, Kyphosis, Bow Legs and Scoliosis, Corrective Measures for Postural Deformities

Training and Planning in Sports

- Meaning of Training

- Warming up and limbering down
- Skill, Technique & Style

Psychology & Sports

- Definition & Importance of Psychology in Physical Edu. & Sports
- Define & Differentiate Between Growth & Development
- Adolescent Problems & Their Management
- Emotion: Concept, Type & Controlling of emotions
- Meaning, Concept & Types of Aggressions in Sports.

Doping

- Meaning and Concept of Doping
- Prohibited Substances & Methods
- Side Effects of Prohibited Substances

Sports Medicine

- First Aid – Definition, Aims & Objectives.
- Sports injuries: Classification, Causes & Prevention and Management of Injuries: Soft Tissue Injuries and Bone & Joint Injuries

Unit-2

(Practical-Sports Specific) Each student has to compulsorily opt for one game/sport so that he/she can be assessed on their performance in the same accordingly for all the 03 years.

Each student will be given practical knowledge about the basic fundamentals of various games and sports and Athletic Events be it Track or Field thereby developing the skill.

Following sub topics related to any one Game/Sport of choice of student out of: Athletics, Badminton, Basketball, Chess, Cricket, Kabaddi, Lawn Tennis, Swimming, Table Tennis, Volleyball etc.

1. History of the Game/Sport.
2. Latest General Rules of the Game/Sport.
3. Specifications of Play Fields and Related Sports Equipment.
4. Important Tournaments and Venues.
5. Sports Personalities.
6. Proper Sports Gear and its Importance

REFERENCE BOOKS:

1. Modern Trends and Physical Education by Prof. Ajmer Singh.
2. Health and Physical Education – NCERT

Distribution of Marks: Total 100 (10+30+20+40)

1. Class Attendance / Punctuality –	10 marks
2. Active Participation Sports Related Activities - (CITIUS, RUN FOR Unity, Prabhat Pheri etc.)	30 marks
3. Viva/Subject Knowledge-	20 marks
4. Practical Exam at the end of 6th Sem (Modified Fitness Test)-	40 marks

Note – PWD Students will be exempted from taking part in physical activities and the Modified Physical Fitness Test.

Syllabus and Evaluation Scheme of Yog
Compulsory for up to B.Tech 6th Semester Students

Course Code: SWNC101	**L**	**T/P**	**C**
Course Title: Yoga	**0**	**4**	**2**

Introduction: Yog education in Institute can immensely contribute to health of children by disseminating knowledge and awareness about the value of health, inculcating and nurturing health promoting habits and life style.

Objectives of the course:

- To enable the student to have good physical and mental health.
- To improve cognitive ability.
- To improve the level of consciousness.

UNIT-I

Introduction to Yog

- Brief introduction to origin of Yog, Psychological aspects leading to origin of Yog, Hindu Mythological concepts about origin of Yog
- History and Development of Yog
- Etymology and Definitions of Yog, Aim and Objectives of Yog, Misconceptions about Yog, True Nature of Yog
- General Introduction to Schools of Yog
- Principles of Yog, Yog Practices for Health and Harmony

UNIT-II

Yog and You

- **Concept of Health-** Aahaar, Nidra, Bharmacharaya, Viyayaam.
- **Aarogya -** Prevention, Cure and Remedies.
- Life Management and Development.

UNIT-III

Yog for Health Promotion –

- Brief introduction to human body
- Role of yog for health promotion
- Yogic attitudes and practices
- Holistic approach of yog towards the health and diseases
- Introduction to yog diet and its relevance and importance in yog Sadhana
- Dincharya and Ritucharya with respect of yogic lifestyle

UNIT-IV

Yog as Preventive measure for Lifestyle Disease

- **Obesity:** Procedure, Benefits & Contraindications for Tadasana, Katichakrasana, Pavanmuktasana, Matsayasana, Halasana, Pachimottansana, Ardha – Matsyendrasana, Dhanurasana, Ushtrasana, Suryabedhan pranayama.
- **Diabetes:** Procedure, Benefits & Contraindications for Katichakrasana, Pavanmuktasana,Bhujangasana, Shalabhasana, Dhanurasana, Supta-vajarasana, Paschimottanasana, Ardha-Mastendrasana, Mandukasana, Gomukasana, Yogmudra, Ushtrasana, Kapalabhati.
- **Asthma:** Procedure, Benefits & Contraindications for Tadasana, Urdhwahastottansana, UttanMandukasana, Bhujangasana, Dhanurasana, Ushtrasana, Vakrasana, Kapalbhati, Gomukhasana Matsyaasana, Anuloma-Viloma.
- **Hypertension:** Procedure, Benefits & Contraindications for Tadasana,

Katichakransan, Uttanpadasana, Ardha Halasana, Sarala Matyasana, Gomukhasana, UttanMandukasana, Vakrasana, Bhujangasana, Makarasana, Shavasana, Nadishodhanapranayam, Sitlipranayam.

UNIT-V (Yogic Practice)

1. YOGIC SUKSMA VYAYAMA

Uccharana-sthalatatha Vishudha-chakra-shuddhi (for throat and voice)
Prarthana (Prayer)
Buddhi-tatha-dhritishakti-vikasaka (for developing will power)
Smaranashakti-vikasaka (for improving the memory)
Medhashakti-vikasaka (for improving the intellect and memory)
Netrashakti-vikasaka (for the eyes)
Kapolashakti-vardhaka (for the cheeks)
Karnashakti-vardhaka (for the ears)
Grivashakti-vikasaka (for the Neck)
Grivashakti-vikasaka (for the Neck)
Grivashakti-vikasaka (for the Neck)
Skandha-tatha-bahu-mulashakti-vikasaka (for the shoulders)
Bhuja-bandhashakti-vikasaka
Kohinishakti-vikasaka
Bhuja-vallishakti-vikasaka
Purna-bhujashakti-vikasaka (for the arms)
Mani-bandhashakti-vikasaka
Kara-prsthashakti-vikasaka
Kara-talashakti-vikasaka
Anguli-mulashakti-vikasaka (for the fingers)
Anguli- shakti-vikasaka (for the fingers)
Vaksa-sthalashakti-vikasaka (for the chest)
Vaksa-sthalashakti-vikasaka (for the chest)
Udarashakti-vikasaka (for the abdomen)
Udarashakti-vikasaka (for the abdomen)
Udarasakti-vikasaka (for the abdomen)
Udarashakti-vikasaka (for the abdomen)
Udarashakti-vikasaka (for the abdomen)
Udarashakti-vikasaka (for the abdomen)
Udarashakti-vikasaka (for the abdomen)
Udarashakti-vikasaka (for the abdomen)
Udarashakti-vikasaka (for the abdomen)
Udarashakti-vikasaka (for the abdomen)
Kati shakti-vikasaka (for the waist)
Kati shakti-vikasaka (for the waist)
Kati shakti-vikasaka (for the waist)
Kati shakti-vikasaka (for the waist)
Kati shakti-vikasaka (for the waist)
Muladhara-chakra-suddhi (for the rectum)
Upasthatatha-svadhisthana-chakra-suddhi (for the genital organs)
Kundalinishakti-vikasaka (for the kundalini)
Janghashakti-vikasaka (for the thighs)
Janghashakti-vikasaka (for the thighs)
Janushakti-vikasaka (for the knees)
Pindalishakti-vikasaka (for the calves)
Pada-mulashakti-vikasaka

Gulpha-pada-pristha-pada-tala-shakti-vikasaka (for the ankles and the feet)
Padangulishakti-vikasaka (for the toes)

2. YOGSANA (Sitting Postures)

Dandasana, Swastikasana, Padmasana,Vajrasana, Supta Vajrasana**,** Kagasana, Utkatasana, Gomukhasana,Ushtrasana, Shashankasana, Janusirasana, Paschimottanasana, Bhramacharyasana, Mandukasana, Utthana Mandukasana, Vakrasana, Ardha Matsyendrasana, Marichayasana, Simhasana

3. **YOGSANA (Supine lying Postures)**

   Pavanamuktasan, Utthana-padasana, Ardha Halasana, Halasana, Setubandha Sarvangasana, Sarvangasana, Matsyasana, Chakrasana, Shavasana

4. **YOGSANA (Prone lying Postures)**

   Makarasana, Bhujangasana, Shalabhasana, Dhanurasana, Kapotasana, Raja Kapotasana

5. **PRANAYAMA (with Antar & Bahya Kumbhaka)**

   Surya-bhedi and Chandra-bhedi Pranayama, Ujjayi Pranayama, Sheetali Pranayama, Shitkari Pranayama, Bhastrika Pranayama

6. **BANDHA**

   Jivha Bandha, Jalandhara Bandha, Uddiyana Bandha, Mula Bandha, Maha Bandha, Tri Bandha

7. **PRACTICES LEADING TO MEDITATION**

   Ajapa Dharana, Yog Nidra, Practices leading to Breath Meditation, Practices leading to Om Meditation

8. **YOGSANA**

   Siddhasana, Bhadrasana, Baddha Padmasana, Uttitha Padmasana, Bhunamanasana, Hanumanasana, Bakasana, Kukkutasana, Garbhasana, Matsyendrasana, Marjariasana, Padangusthasana, Hastapadangusthasana, Garudasana, Vatayanasana, Natarajasana, Mayurasana, Padma Mayurasana, Sirshasana and its variations, Ekapada and Dwipada Kandarasana

9. **MUDRAS**

   Yog Mudra, Maha Mudra, Shanmukhi Mudra, Shambhavi Mudra, Kaki Mudra, Tadagi Mudra, Vipareet Karni Mudra, Simha Mudra

Distribution of Marks: Total 100 (10+30+20+40)

1. Class Attendance / Punctuality –	**10 marks**
2. Active Participation in Sports Related Activities -	**30 marks**
3. Viva/Subject Knowledge-	**20 marks**
4. End Semester Practical Exam (Yogic Practice)-	**40 marks**

National Service Scheme (NSS)

Course Title: NCC/NSS/Yoga | Course Code: SWNC102;

LTP: 002 | Credit: 1 (Semester 1 to 6)

Overall Objective:

Development of Student's personality through community service.

Aims & Objective of NSS:

i. To understand the community in which they work.

ii. To understand themselves in relation to their community.

iii. To identify the needs and problems of the community and involve them in a problem-solving process.

iv. To develop among themselves a sense of social and civic responsibility.

v. To utilize their knowledge in finding practical solutions to individual and community problems.

vi. To develop the competence required for group living and sharing responsibilities.

vii. To gain skills in mobilizing community participation.

viii. To acquire leadership qualities and a democratic attitude.

ix. To develop capacity to meet emergencies and natural disasters.

Joining NSS:

Simply by enrolling/registering yourself in the NSS unit through the NSS Programme Coordinator/Officer concerned.

Guidelines for Evaluating NSS Students

Curriculum's 1-credit Course (Semester 1 to 6)

For the curriculum's credit award to students under NSS, the following procedure will be adopted:

Students should engage in various NSS activities (listed in Annexure-1) for at least 240 hours in three years (minimum 40 Hrs/semester).

The attendance records of students will be maintained by their unit's respective Programme Officer.

A student who participates in different activities of NSS during the 1st to 6th semester then he/she will earn certain hours per activity depending upon his/her role and responsibilities carried out by the volunteer as per the following rules:

S.No.	Role	No. of Hours
1	Audience	Upto 5 Hours
2	Active Participation	Upto 7 Hours
3	Organizer	Upto 10 Hours

Distribution of Marks: Total 100 (20+20+20+40)

Class Attendance: 20

Discipline & Punctuality: 20

Event Knowledge: 20

Comprehensive Viva (for all activities held during the entire semester): 40

Annexure-1 (Tentative NSS Activities Planned for an Academic Year)

Activities
Vanmohotsava Week (5-7 days) (Environment Enrichment & Tree Plantation) (Nearby places like public institutions, adopted villages/slum areas, and wasteland and other such activities)
Disaster Management (Workshops, awareness camps for Relief and rescue work inoculation and immunization, distribution of medicines, essential goods)
Adopted village (visiting some nearby villages and deciding 2-3 villages to be adopted for literacy promotion and basic facilities like drinking water, pucca/kutchha road, school shed/buildings, cooperative/self-employment scheme, etc.)
Independence Day (Participation in the college celebration)
Literacy Week (Pledge-taking ceremony, Visit to adopted village/slum to organize dialogue and discussion, Putting up hoardings and banners at prominent places in the local area)
Health Service & Awareness (Integrated Child Development Programme, Health Education, HIV/AIDS Awareness Programme, Motivating parents to send children to school and other such activities)
"**Annual NSS Day Celebrations**" of NSS
Digital Transactions Awareness Programs ("Startup India – Stand up India")
Blood Donation Camp in collaboration with NITKAA
Autumn Camp (**4-6 days)** in a nearby village (Youth for Sustainable Development with a focus on Watershed Management & Wasteland Development or some other theme)
Gandhi Jayanti (Quiz competition, Speech, Communal Harmony DAY, and other such activities)
Quami Ekta Week (National Integration Day, Welfare of Minorities Day, Cultural Unity Day, Women's Day, Conservation Day)
Swachhta Pakhwada (various activities like cleanliness campaigns in campus, locality, road safety, and other such activities engaging GOI Ministries/Departments initiatives)
Legal Literacy-Social Justice (Lecture by relevant person and other activities
World AIDS Day (creating awareness among school and college-going students, organizing lectures, public discussions, film shows, rallies and street plays)
Energy Conservation Day (awareness programme and other activities

National Youth Week (Lectures/Symposia on the philosophy and teaching of Swami Vivekanand, Mahatma Gandhi; Debate on the role of youth in the contemporary situation; Essay/drawing competitions amongst youth)
Republic Day (Participation in the college celebration)
Nasha Mukti Abhiyan (Awareness on the part of Tobacco Free Society; campaigns, posters, programmes in Hostels)
Women's Week (Special programmes regarding the significant role of women and girl child; Prominent women leaders lectures; awareness programmes and other such activities)
National Safety Day/ Week (Activities based on a theme provided by National Safety Council (GOI))
Life Skills and Vocational Training Programmes (Industry professional for lectures, competitions and other such activities)
Career Guidance (For college students through prominent speakers; NSS volunteers going to schools to provide guidance to 9-12th students and other such activities)
Environment Enrichment & Climate Change (Special programmes like lectures, campaigns, posters and other such activities)
World Bicycle Day Celebration
Other Activities: Activities suggested by Institute, State NSS Unit, MHRD, GOI Ministries etc.

Guidelines for evaluation of student activities under Students Clubs
(1st to 6th Semester: 02 credit)

The Students Clubs provide facilities and the right environment to develop extra-curricular skills in the students, in addition to the academic knowledge imparted by the Institute. Twelve (12) different clubs are working under Students Clubs which organized various events (workshops, guest lecturers etc.) and competitions, to instil the spirit of healthy competition among students, throughout the year. A national level mega cultural festival under the name CONFLUENCE is organized every year. Students can earn course credit by participating in various events organised by the student's club and assisting in coordinating these events as a member of these clubs.

For the credit award to students under students club, following is recommended:

1. Students must engage in club activities for 240 hours in three years (40 hours in one semester).
2. The evaluation criterion and activity hours will be calculated as follows:

SNo	Evaluation Criterion	Number of hours credited	Distribution of Max Marks 100 (Weightage 80%)
1.	Participation as an Audience	0.5 hour* number of event hours	--
2.	Participation as an Performer	(a) 06 hours for full day activity (b) 03 hours for half day activity	10 05
3.	Prize/Award/Recognition (intra - college events)	05 hours	20
4.	Prize/Award/Recognition (inter - college events)	10 hours	30
5.	Organization of event	(a) 12 hours for full day activity (b) 06 hours for half day activity	20 10
6.	Sponsorship Note: Number of hours will be equally divided among students involved where minimum Rs. 25,000/- per students must be ensured.	(a) 15 hours for sponsorship upto 01 Lakh (b) 30 hours for sponsorship upto 05 Lakh (c) 40 hours for sponsorship more than 05 Lakh	(a) 15 (b) 30 (c) 40 Note: Marks will be divided equally in team members, if any

3. The comprehensive viva-voce (**Weightage 20%**) will be conducted at the end of every semester.
4. Documents required as proof:

a. **Participation**: A certificate of participation duly signed by the organizing club's faculty-in-charge. All clubs will maintain a record of certificates issued for verification.
b. **Prize/Reward/Recognition**: A Certificate of Merit/Letter of Appreciation duly signed by Head of the Institute/Dean (SW)/Professor-in-charge of Students Club.
c. **Organization**: A Certificate of Appreciation mentioning event's name and committee's name in which the student contributed.
d. **Sponsorship**: A letter of sponsorship from sponsoring organization mention amount and list of students involved in sponsorship effort. The amount will be equally divided among the students for award of hours and marks as per criterion 6.

Note:

1. Faculty in charges of the individual clubs must ensure at least 40 hours of activities per semester and must keep the record of number of hours for each and every student involved/ registered for clubs.
2. Further, workload of two (02) hours per week should be included as teaching load for faculty in-charges (FIC) and Professor In-charges (PIC) in order to ensure smooth conduct of activities of the clubs.
3. It is recommended to make provision for earned leave for organising events in non-working days.

Guidelines for evaluation of student activities under Technical Societies
(Semester 1st to 6th: 240 hrs.: 1 credit)

There are 12 societies/clubs currently under technical societies which conduct various events (competitions, workshops, guest lectures, meetings etc.) throughout the year and one major event TECHSPARDHA, the annual technical festival is conducted once a year. Each of this society/club is headed by a team of students usually from final year of their programme under the guidance of a faculty-in-charge.

Under new curriculum for B. Tech students, the activities of all technical societies/clubs are to be considered as an audit course. The credit for this course will be awarded at the end of 6th semester.

Students can earn course credit by participating in various events organised by the technical societies and help in coordinating these events as a member of these societies/clubs. The selected heads of societies/clubs under supervision of faculty-in-charge will ensure that each member is engaged in the activities of society/club for at least 40 hours in each semester (240 hours in 6 semesters) to fulfil the requirement of award of credits

At the end of sixth semester the evaluation of student will be carried by a committee of faculty-in-charges of the technical societies. They will be awarded points on following criterion:

Sr. No.	Criterion	Semester I and II (max 20 marks)	Semester III and IV (max 30 marks)	Semester V and VI (max 50 marks)
1.	Participation	1/event	1.5/event	2/event
2.	Prize/Award/ Recognition (intra-college events)	2/event	3/event	4/event
3.	Prize/Award/ Recognition (inter-college events)	4/event	6/event	8/event
4.	Organization	4/event	6/event	8/event
5.	Sponsorship	4/ (Rs10K worth of sponsorship individually)	6/ (Rs20K worth of sponsorship individually)	8/ (Rs40K worth of sponsorship individually)

The committee will duly verify the credentials of each candidate and award marks on above criterion. Student will be awarded a grade as per institute norms.

Documents required as proof:

a. Participation: A certificate of participation duly signed by the organizing club's faculty-in-charge. All societies/clubs to maintain a record of certificates issued for verification.
b. Prize/Reward/Recognition: A Certificate of Merit/Letter of Appreciation duly signed by Head of the Institute/Dean(R&C)/Professor-in-charge of Technical Societies.
c. Organization: A Certificate of Appreciation mentioning event's name and committee's name in which the student contributed, duly signed by the faculty-in-charge of the organizing club.
d. Sponsorship: A letter of sponsorship from sponsoring organization mention amount and list of students involved in sponsorship effort. The amount will be equally divided among the students for award of marks as per criterion 5.

Bearing in mind that the activities of clubs/societies are a part of curriculum now, following recommendation may kindly be considered:

1. Adequate space may be allocated to each society/club for conducting meeting, storing materials and equipment and keeping records.
2. Adequate staff and office space be provided to professor-in-charge (Technical Societies) keep track of purchases, maintain accounts and records and secretarial assistance.
3. An engagement of one hour per week in the load of faculty-in-charge be shown in timetable to compensate for time devoted to the activities of club/societies.

PIPC209: PRODUCTION TECHNOLOGY-II

Pre-requisite: **Production Technology-I**

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief description about the course

Production Technology covers to an extensive view of machine tools selection, methods and economical production feasibility decision. The proposed course is targeted on providing insight into the basics of economically usable production technology such as grinding wheels and machines applications, sheet metal operations and die materials selections, Analysis of metal forming processes, thread manufacturing practices. The students will also learn to the various machining operations, workpiece design and tools (grinding wheels, die materials, thread manufacturing) applications skills, and also understand the concept of economical tools life cycle and wear control, tools selection in specific workpieces application environment.

UNIT-I

Grinding Wheels & Machines: Common abrasives, grinding wheel materials, Bonds, Grain structure and shapes of common wheels, Operations and applications of surface, cylindrical, centre less and internal grinding processes, dressing, truing and balancing of grinding wheels, grading and selection of grinding wheels, Mechanics of grinding, machining time calculation. Principles and applications of honing, super finishing, lapping, polishing, buffing, peening, and burnishing. **(10hrs)**

UNIT-II

Sheet metal operations and die materials: Introduction of sheet metal fabrications and thickness, classification of presses, shearing action, cutting forces, clearance and its effect, shear, angular clearance, stripper, center line of pressure and its mathematical calculation. Die materials, Die types, construction details of die set, auxiliary equipment, safety devices. Automatic lathe: Introduction, classification, tooling layout.

(10 hrs)

UNIT-III

Forming processes: Plastic deformation and yield criteria, relationship between tensile and shear yield stresses, Friction conditions in metal working, Analysis of forming processes: Rolling, forging, wire drawing, extrusion, temperature and lubrication aspect in metal forming, forming defects. **(10 hrs)**

UNIT-IV

Thread manufacturing: Introduction; applications of screw threads, threads terminology, classification, and methods of thread manufacturing: casting, thread cutting: single point & multi point tools, thread rolling, die threading, thread milling, thread grinding and tapping, calculation of blank size. **(10 hrs)**

NOTE:

The focus of concluding lectures should be to emphasize the value addition of the subject and also on how it impacts the environment. Further, the faculty may suggest possible sustainable solutions/emerging technologies/innovations towards sustainability in the subject domain.

Text Books / Reference:

1. DeGarmo, E. P., Black, J.T., and Kohser, R.A., “Materials and Processes in Manufacturing”, Prentice-Hall of India.
2. Kalpakjian, S., and Schmid, S.R., “Manufacturing Engineering and Technology”, Pearson Education.
3. Groover, M.P., “Fundamentals of Modern Manufacturing”, John Wiley & Sons.
4. Lindberg, R.A., “Processes and Materials of Manufacture”, Prentice-Hall of India.
5. Boothroyed, G. et al., Fundamentals of Metal Cutting and Machine Tools, McGraw Hill.
6. Rao,P.N., “Manufacturing Technology”, Vol 1 & 2, Tata McGraw-Hill.
7. Ghosh and Mallik, “Manufacturing Science”, E.W. Press.
8. Pandey and Singh,“Production Engineering Science”.
9. Avitzur, B., “Metal Forming: Processes and Analysis”, Mc-Graw Hill.
10. Hazra & Choudhary Workshop Technology Vol. II Tata MCGraw Hill

Course Outcomes

CO1: To understand the various types of grinding wheels applications in workpiece requirements and super-finishing operations. The students able to select the appropriate grinding wheels and processes for specific materials requirement.

CO2: The extensive knowledge of sheet metals operations, die-design and appropriate die selection of as for required products specific requirements.

CO3: To understand the detailed analysis of metal forming processes, temperature and lubricants aspects in metal forming to overcome the energy losses and wear of equipment’s used for metal forming.

CO4: To understand the different approaches are used for various types of thread productions as per fit in the mechanical properties requirement.

PIPC210: OPERATION RESEARCH

Pre-requisite: NIL

L	T	P	Credits	Total contact hours
3	0	0	3	40 hrs

Brief Description about the course

Operation research uses Mathematical techniques to model, analyze and solve the problem today's business has to face a large number of constraints. The operation research techniques can help the executives to express business constraints into measurable terms. A number of operation research techniques that provide the scientific basis to generate the alternatives and select the optimum solution are covered

UNIT – I

Introduction: Development of Operation Research, Characteristics and Scope of Operation Research in management, Models in operation research, Model formulation, Types of Mathematical models, Limitation of operation research.

Linear programming: Introduction, Terminology, Advantages, Limitations and applications of linear programming, Illustrative problems on formulation of linear programming model, Graphical Method of solution, Simplex method, Artificial variable technique for solving the Initial basic feasible solution (Big M-Method), essence of duality theorem , Sensitivity analysis.

(10 hrs)

UNIT – II

Transportation Model: Introduction to transportation Problems, Mathematical model for Transportation Problem, Methods for initial basic solution: Northwest corner method, Least cost method, ROW Minima Method, Column Minima Method, Vogel's approximation method, Degeneracy in transportation, Optimal solution using Modified Distribution Method, Special cases- Unbalanced problems and profit maximization problems.

Assignment Model: Introduction to Assignment, Mathematical formulation of the assignment problem, Hungarian Method. **(8 hrs)**

UNIT - III

Sequencing Models: Sequencing Problems, Processing n jobs through two Machines, Processing n jobs through three Machines, Processing two jobs through m Machines, Processing n jobs through m Machines, The Travelling salesman Problem.

Simulation: Introduction, Monte Carlo Simulation, Random Numbers, Procedure for Monte Carlo Simulation, Advantages of Simulation, Industrial Application of Simulation. **(10 hrs)**

UNIT – IV

Decision and Game theory: Introduction, Steps in Decision Theory approach, Decision making Environments, decision Making under condition of Certainty, Decision Making under condition of Uncertainty, Decision Making under condition of Risk, Decision Trees, Theory of games, Competitive games, Terminology, Rules for Game Theory , Two person zero sum game, Solution of 2*2 game with no saddle point, Dominance in Games, Sub-game Method to solve (2*n or m*2) Mixed strategy games, Graphical Method to solve (2*n or m*2) games, mixed strategy (3*3) games.

PERT AND CPM: Introduction, Objectives of PERT and CPM, Terms related with PERT and CPM, Rules for Network Construction, Numbering of Events(Fulkerson's Rule), Frequency distribution Curve for PERT,PERT Computations, slack, Critical Path, Probability of meeting the scheduled dates, CPM, terms, Critical Path, Float, Cost Analysis, Contracting and Updating.

(12 hrs)

NOTE:

The focus of concluding lectures should be to emphasize the value addition of the subject and also on how it impacts the environment. Further, the faculty may suggest possible sustainable solutions/emerging technologies/innovations towards sustainability in the subject domain.

Text Books / Reference books

1. P.K.Gupta and D.S.Hira “Operation Research ,S.Chand Co. 2007
2. Manohar Mahajan ”Operation Research” Dhanpat Rai &Co.(Pvt.) Ltd.
3. P.Sankara Iyer, “Operation Research” Tata McGraw-Hill,2008
4. J.K.Sharma, ”Operation Research, Problems and Solutons,3e”, MacMillan India Ltd.

Course Outcomes

CO1: The students will be able to formulate real world problems as Mathematical model and solve Linear Programming problems

CO2: Student will be able to formulate and solve transportation and Assignment problems

CO3: The student will be able to solve sequencing problem and perform Simulation

CO4: The student will be able to solve game theory and Decision theory problems

PIPC211: STRENGTH OF MATERIALS

Pre-requisite: **NIL**

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief Description about the course

This course will introduce the students to a thorough understanding of structural members and their strength, stiffness, and stability. Develop an understanding of, and the capability to, solve practical engineering problems involving stress and strain analysis in elementary structural members, such as bars and beams. To this end, the learning objectives of this course are:

a. To learn about the simple and compound stresses at a point in a material.
b. To study the various theories of failure of materials.
c. To know about the shear forces, bending moments, bending stresses and shear stresses in a beam.
d. To study torsion of shafts and to find the deflection of beams.
e. To learn about various types of stresses in thin cylinders and columns.

UNIT-I

Simple Stress and Strain: Mechanical Properties of Materials, Concept of stress and strain, various type of stresses, stress-strain diagrams, composite sections, Thermal stresses, strain analysis, relation between elastic constants.

Compound Stress: Principal stresses and principal planes, Mohr's stress circle.

Theories of Failure: Different theories of failure, Significance, graphical representation.

(10 hrs)

UNIT-II

Shear Force and Bending Moment Diagrams: Shear force and bending moment diagrams for various types of loading and supports, Point of contra flexure.

Bending Stress in Beams: Stresses due to simple bending, Composite beams.

Shear Stress in Beams: Shear stress distribution, Variation of shear stress in beams of various sections **(10 hrs)**

UNIT-III

Torsion: Derivation of torsion equation and its assumptions, applications of the equation to the hollow and solid circular shafts.

Slope and Deflection: Slope and deflection at a point using different methods, deflection of beams due to shear stress. **(10 hrs)**

Unit – IV

Thin Cylinders and Spheres: Thin cylinders and spheres subjected to internal pressure, wire winding of thin cylinders.

Columns: Euler's theory for initially straight columns, assumptions and limitations, empirical formulae. **(10 hrs)**

NOTE:

The focus of concluding lectures should be to emphasize the value addition of the subject and also on how it impacts the environment. Further, the faculty may suggest possible sustainable solutions/emerging technologies/innovations towards sustainability in the subject domain.

Text Books / Reference

1. G H Ryder, *"Strength of Materials",* ELBS, 3rd edition, 1969
2. S S Rattan, "Strength of Materials", Tata McGraw Hill, India, 3rd Edition, 2017
3. Beer P F and Johnston (Jr) E R, *"Mechanics of Materials",* McGraw Hill Education, 7th edition, 2015.
4. Popov E P, *"Engineering Mechanics of Solids",* Prentice Hall of India, New Delhi, 2nd edition, 1999.

Course Outcomes

CO 1: Determine the values of stresses in materials

CO 2: Explain different theories of failure

CO 3: Draw shear force and bending moment diagrams

CO 4: Find shear and bending stresses in beams

CO 5: Find stresses in shafts under torsion and to find the slope and deflection of beams

CO 6: Find stresses in the thin cylinders and to calculate the crippling load in Columns

PIPC212: HEAT TRANSFER

Pre-requisite: Fluid Mechanics and Machines

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief Description about the course

This course is an introduction on to understand the mechanism of different modes of heat transfer i.e. conduction, convection and radiation. It also involves solving different numerical problems related to heat transfer and also to design heat exchangers used in numerous heat transfer applications.

UNIT-I

Conductive Heat Transfer: Review of the basic laws of conduction, convection and radiation. General heat conduction equation in different co-ordinates. One dimensional steady state conduction without heat generation; plane slab; cylindrical shell; spherical shell.

Extended Surfaces: Fins of uniform cross-section: Governing equation; Temperature distribution and heat dissipation rate for different boundary conditions; Efficiency and effectiveness of fins.

(8 hrs)

UNIT-II

Introduction to Convective Heat Transfer: Introduction to convection boundary layers, local and average convection coefficients, laminar and turbulent flow, boundary layer equations, boundary layer similarity, Reynolds analogy.

Forced Convection- External Flow: Empirical method, flat plate in parallel flow, cylinder in cross flow, flow over a sphere

Forced Convection- Internal Flow: Hydrodynamic and thermal considerations, energy balance, laminar flow in circular tubes, convection correlations. Natural Convection: Physical considerations, governing equation, laminar free convection on a vertical surface, empirical correlations (**12 hrs)**

UNIT-III

Radiative Heat Transfer: Fundamental concepts, radiation intensity, irradiation, radiosity, black body radiation, Basic laws of radiation, emission from real surfaces, absorption, reflection and transmission by real surfaces, Kirchoff's law, Gray surface, radiative heat exchange between two or more surfaces.

View factor concept: View Factor, radiation exchange between opaque, diffuse, gray surface in an enclosure; Black body radiation exchange, two-surface enclosure, radiation shield.

(12 hrs)

UNIT-IV

Heat Exchangers: Basic design methodologies – LMTD and effectiveness NTU methods, overall heat transfer coefficient, fouling of heat exchangers, classification of heat exchangers according to constructional features: tubular, plate type, extended surface heat exchanger, Introduction of compact heat exchangers. Application of the fundamentals of heat transfer in heat transfer devices and processes.

(8 hrs)

NOTE:

The focus of concluding lectures should be to emphasize the value addition of the subject and also on how it impacts the environment. Further, the faculty may suggest possible sustainable solutions/emerging technologies/innovations towards sustainability in the subject domain.

Reference/Text Books:

1. Incropera, Dewitt, Bergmann and Levine, “Fundamentals of Heat and Mass Transfer”, Wiley India, 2006.
2. J.P. Holman, “Heat Transfer”, McGraw Hill, 1996.
3. D.S. Kumar, “Heat and Mass Transfer”, Katson Publication, 2013.
4. Kreith and Bohn, “Principles of Heat Transfer”, Cengage Learning, Inc. 7th Edition, 2009.
5. N.H. Afgan and Schliinder, “Heat Exchangers Design and Theory”, McGraw Hill.

Course Outcomes

CO1: The students will be able to formulate and analyse a heat transfer problem involving conduction mode of heat transfer.

CO2: The students will be able to formulate and analyse a heat transfer problem involving convection mode of heat transfer.

CO3: The students will be able to design devices such as heat exchangers employing all the three modes of heat transfer.

CO4: The students will be able to design devices such as heat exchangers employing all the three modes of heat transfer.

PIPC213: MACHINE DRAWING

L	T	P	Credits	Total Contact Hours
1	-	5	3	78

Prerequisite: Engineering Graphics

Brief Description

The student is enabled to:

- Study the conventions and rules to be followed by engineers for making accurate drawings.
- Understand the basic dimensioning practices that have to be followed in the preparation of drawings.
- Prepare the assembly of various machine or engine components and miscellaneous machine components.
- Visualize the assembly and sub assembly of various machine elements.

UNIT-I

Fasteners: Definition of various parts of a screw thread, Popular Forms, Conventional representation, Multiple start threads, Right and Left Hand threads, Screwed Fasteners bolts, nuts, stud bolts, tap bolts, set screws, Riveted joints for plates, Various types of welded joints and conventions

Joints: Drawing of simple machine parts i.e. cotter joint, knuckle joint

Bearing and Couplings: Simple solid, bushed, pedestal, footstep bearings, Flanged coupling Flexible couplings-Bushed pin type flanged coupling **(33 hrs)**

UNIT-II

Assembly Drawing

Introduction of unit assembly drawing, Practice in drawing details and assembly of simple units like:

Simple Steam Engine Parts; Stuffing boxes, Cross heads, Eccentrics Boiler Mountings: Steam stop valve, feed check valve and safety valves.

Machine tool parts: Tool Post, Tool Head of a Shaper. **(45 hrs)**

Note: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

NOTE:

The focus of concluding lectures should be to emphasize the value addition of the subject and also on how it impacts the environment. Further, the faculty may suggest possible sustainable solutions/emerging technologies/innovations towards sustainability in the subject domain.

Text / Reference Books:

Machine Drawing - N.D. Bhatt, Charotar Publisher.

Machine Drawing - Sidheshwar, Tata McGraw-Hill

A text book of Machine drawing - R.B. Gupta, Satya Prakasham Tech. Pub.

Machine Drawing –K.L.Narayana, P.Kannaiah& K. Venkata Reddy,New Age Publishers

Machine Drawing – P.S.Gill.

Machine Drawing – Luzzader

Machine Drawing – Rajput

Course outcomes:

CO1: Demonstrate knowledge about the various practices with regard to the dimensioning, sectioning and development of views.

CO2: Understand the importance of the linking functional and visualization aspects in the preparation of the part drawings

CO3. Develop assembly drawings using part drawings of machine components with dimensions and bill of material during design and development.

CO4: Enhance their ability to work as practicing mechanical engineers in manufacturing Industries and consulting firms

PIPC214: VALUE ENGINEERING

Pre-requisite: **Nil**

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief description about the course

Production Economics covers a wide range of tools, methods and techniques of Engineering Economics for Evaluation of the economic feasibility of single project as well as comparative evaluation of multiple alternatives. This course is targeted on providing insight into the basics of economics such as classification of costs, Computation of total production cost, depreciation of equipment, equipment replacement, Selection of equipment with highest ROI, etc. The students will also learn to apply the concepts of value engineering for optimization of the value of a product design and cost cutting techniques for economical production.

UNIT-I

Introduction: Nature and purpose of engineering economy studies, Principles of engineering economy, Engineering Economy and the Design Process.

Industrial Costing: Classification of costs: Direct cost, indirect cost and overhead cost, fixed and variable cost, semi-fixed cost, differential and marginal cost, sunk cost and its reasons, Book cost, Total manufacturing cost, Total revenue Function, Life cycle cost, Breakeven Analysis, Cost Driven Design Optimization, Present Economy studies, numerical problems. **(10 hrs)**

UNIT-II

Depreciation: Classification of depreciation, methods of computing depreciation, Straight Line method, Declining Balance method, Units of production Method, The modified accelerated cost recovery system.

Project Evaluation Methods: Relating Present and future Equivalent values of cash flows, Concept of Annuity, Computation of Annual worth, Present worth and Future Worth for Single cash flows and annuity, Deferred Annuities, Effective and nominal rate of interest, Present worth method, Annual worth method, Capital recovery amount and EUAC, The internal rate of return (IRR) method, External rate of return method (ERR), Payback period method, Comparative merits and demerits of the methods, Numerical problems on economic feasibility of projects/industrial equipment. **(10 hrs)**

UNIT-III

Comparative Evaluation of Multiple projects: Basic Concepts of Comparing Alternatives, The Study Period, Methods for Useful life equal to study period, Equivalent worth methods, Rate of return Methods, Incremental analysis, Unequal useful lives among the alternatives, Case studies on Selection of most economical equipment, Equipment generating highest ROI.

Equipment Replacement Studies: Reason of replacement, Determining economic life of new assets, Defender, Unequal useful lives of challenger and defender, Retirement of equipment without replacement, Replacement of assets for sustainable production. **(10 hrs)**

UNIT-IV

Value Engineering: TOP down Vs. Bottom up approaches in costing, Value Engineering Defined, VE benefits, Objectives and potential applications, VE over a system's Lifecycle, VE methodology: Orientation Phase, Information Phase, Functional Analysis Phase, Creative Phase, Evaluation Phase, Development and presentation, implementation phases. Establishing the VE program, case study on VE Implementation and cost reduction. **(10 hrs)**

NOTE:

The focus of concluding lectures should be to emphasize the value addition of the subject and also on how it impacts the environment. Further, the faculty may suggest possible sustainable solutions/emerging technologies/innovations towards sustainability in the subject domain.

Text Books / Reference

1. Leland Blank, Anthony Tarquin; Engineering Economy, McGrawhill Education (India), New Delhi, 2017.ISBN13: 978-1-25-902740-6
2. William G. Sullivan, C. Patrick Koelling; Engineering Economy, Pearson Education (Asia), 2017.
3. Grant, E.L., Grant, W., and Leavenworth, R.S., Principles of Engineering Economy, John Wiley & Sons, 2015.
4. Mukhopadhyay.Anil, Value Engineering: Concepts, techniques and applications, Sage publishers, ISBN- 9780761997894, 9780761997894

Course Outcomes

CO 1: Apply the appropriate engineering economics analysis method(s) for problem solving: present worth, annual cost, rate-of-return, payback, break-even, benefit-cost ratio.

CO 2: Evaluate the cost effectiveness of individual engineering projects using the methods learned and draw inferences for the investment decisions.

CO 3: Compare the life cycle cost of multiple projects using the methods learned, and make a quantitative decision between alternate Equipments/Projects

CO 4: Optimize the value of a product considering the basics of value engineering and cost cutting techniques

PIPC215: MATERIAL SCIENCE

Pre-requisite: Nil

L	T	P	Credits	Total contact hours
3	0	0	3	40

Brief description about the course:

This course will introduce the students to concepts of crystallography, alloy formation, and phase diagrams. Various mechanisms of plastic deformation, strengthening mechanisms, and mechanical properties of engineering material will be discussed. The students will gain useful knowledge about heat treatment procedures adopted in the industries and their effect on mechanical properties. The students will also learn about the various types of engineering materials for different applications.

UNIT-I

Introduction to crystallography and alloy formation: Bonding in Solids: Ionic, Amorphous and Crystalline, Lattice, Unit cell, Bravais lattice, Types of crystals, Linear and Planer densities, Crystal defects (Point, Line, Surface and Volume defects), Solid solution, Binary phase diagrams: Gibbs phase rule, lever rule, Types of Binary phase diagrams (Isomorphous, Eutectic, Partial-Eutectic systems), Iron-Carbon phase diagram.

(10 hrs)

UNIT-II

Plastic deformation and Mechanical Properties: Tensile Test-Elastic and Plastic deformation and Strain hardening with respect to Stress-Strain Curve, Dislocation motion, Work hardening and dynamic recovery, work softening, Bauschinger's effect, grain boundaries, Strengthening Mechanisms, Recovery, Recrystallization, Grain growth, Cold and hot working, Impact Test, Fatigue failure, SN curve, Creep Test: Creep curve, Creep fracture, Material consideration for high-temperature use. **(10 hrs)**

Unit-III

Heat Treatment: Purpose of Heat treatments, Common heat treatments like Annealing, Normalizing, Hardening, Tempering, Martempering, and Austempering, Precipitation hardening, TTT and CCT diagrams, Surface hardening (carburizing, Nitriding, carbo-nitriding, cyaniding, Flame, and Induction hardening), Various types of hardness Tests.

(10 hrs)

UNIT-IV

Engineering Materials: Metals (Iron, Copper, Aluminium, Magnesium, Titanium etc., Alloys (Fe-alloys, Al-alloys, Mg-alloys, Copper Alloys, Titanium Alloys, etc.), Polymers: Thermoplastic and Thermosetting polymers, Ceramics: Types of ceramics, applications, Powder Metallurgy, Composites: Classification, applications. Case study: study of the microstructure, phases, mechanical behaviour and effect of heat treatment on steel specimen.

(10 hrs)

NOTE:

The focus of concluding lectures should be to emphasize the value addition of the subject and also on how it impacts the environment. Further, the faculty may suggest possible sustainable solutions/emerging technologies/innovations towards sustainability in the subject domain.

Text Books/Reference:

1. Material Science and Engineering - V. Raghavan, Prentice Hall
2. Materials Science and Engineering An Introduction - W.D. Callister, John Wiley
3. Mechanical Behaviour of Materials – McClintock & Argon, Addison-Wesley
4. Mechanical Behaviour of Materials - Courtney, McGraw-Hill
5. Mechanical Metallurgy-Dieter

Course Outcomes:

CO 1: Understand and distinguish between the various types of bonding in solids, defects in materials, and phase diagrams.

CO 2: Explain the mechanism of plastic deformation, strengthening, and behavior of materials under various types of loading conditions.

CO 3: Explain and suggest heat treatment techniques to improve the mechanical properties of various types of steel

CO 4: Suggest the use of engineering materials for different applications

PIPC216: PRODUCTION TECHNOLOGY-II (P)

Pre-requisite: **PT-I (P)**

L	T	P	Credits	Total contact hours
0	0	2	1	24

Brief description about the course

This course will give hands on training to the undergraduate students for various experiments related to production technology such as MIG/TIG welding, Wire EDM, CNC turning/milling, Tool Life equation, Rotary USM etc. Students will learn to use the equipment and perform practical on the same.

List of Experiments:

1. To perform different operations of CNC turning center and measure the force and vibration during machining
2. To perform machining (square shape) on CNC-wire cut EDM machine and study the effect of electrical parameters on Cutting speed
3. Study and experiment on Robotic Pulse MIG welding cell
4. Study and experiment on robotic pulse TIG Welding Cell
5. To Perform milling operation on CNC Vertical milling Center and measure cutting force during milling
6. To Perform drilling operation on Rotary Ultrasonic Machining Set up
7. Gear cutting by milling and hobbing processes
8. Testing the sand properties- mould harness and grain size
9. Study and experiment on tool life in turning operation

Course Outcome:

PIPC217: STRENGTH OF MATERIALS PRACTICAL (P)

Pre-requisite: None

L	T	P	Credits	Total contact hours
0	0	2	1	30

Brief Description:

This course will introduce the students to the instruments and experimental methods used in Material Testing. Therefore, the learning objectives of this course are:

- To understand the behavior of materials under different tests like hardness, impact, tensile, etc.
- To understand the basic principles of strength of materials and structural analysis.
- To understand the concept of stress and strain under different loading conditions.
- To understand the mechanics of different testing machines like Servo hydraulic UTM, Servo electric UTM, etc.

List of Experiments:

1. To study the Impact testing machine and to perform the impact tests (Izod and Charpy impact test).
2. To study the Rockwell Hardness testing machine and find the Rockwell Hardness of the given specimen.
3. To study the Vickers Hardness testing machine and find the Vickers Hardness of the given specimen.
4. To study the Brinell Hardness Testing machine and find the Brinell Hardness of the given specimen.
5. To study the Erichsen Cupping machine and find out the Erichsen value of the given specimen of Sheet Metal.
6. To study the Bending stress in a Beam Structure and to find the Bending Stress in a Beam.
7. To study the Torsion testing machine and to perform the Torsion test on a given specimen.
8. To study the Universal Testing Machine(UTM) and to perform the Tensile test.
9. To perform the Compression test on Universal Testing Machine (UTM).
10. To perform the Bending Test on Universal Testing Machine (UTM).
11. To study the Strut-Testing Structure and to determine
    a. The Buckling Load of a Pinned-End Strut
    b. The effect of End Conditions on the Buckling Load.

Course outcomes:

CO1: Understand the procedure of doing different tests like hardness, compression, torsion, tension, impact, etc. in various materials.

CO2: Understand the effect of stress and strain in different types of machines/structures under different loading conditions.

CO3: Describe the behavior of materials upon normal external loads.

CO4: Predict the behavior of the material under impact conditions.

CO5: Recognize the mechanical behavior of materials.

CO6: Measure the properties of the materials such as impact strength, tensile strength, compressive strength, hardness, ductility, etc.