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||Jai Sri Gurudev||

Sri Adichunchanagiri Shikshana Trust (R.)

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

AICTE Approved, Accredited by NAAC with A+ Grade & NBA (CSE, ISE, ECE, ME & CV), NIRF(151-300) in 2023,Gold Rated by QS I-Gauge

P.B. No.20, B.B Road, Chikkaballapur - 562 101, Karnataka

Estd : 1986

V Semester

Scheme & Syllabus of B.E. Programme

Mechanical Engineering

(2024 Scheme)

Core Values

Spiritual, **J**udicious, **C**ommitment, **I**ntegrity, **T**rustworthy



NATIONAL INSTITUTIONAL RANKING FRAMEWORK 151-300

A+ NAAC

QS I-GAUGE GOLD

INSTITUTION'S INNOVATION COUNCIL (Ministry of HRD Initiative) 4-Star Rating

SJC INSTITUTE OF TECHNOLOGY, CHIKKABALLAPURA

An Autonomous institution Under VTU from 2024 – 2025

AICTE Approved, Accredited by NBA(CSE, ISE, ECE, ME, CV, AE) and NAAC with 'A+' grade, QS – I Gauge Gold Rated

SCHEME OF TEACHING AND EXAMINATION – B.E. – Mechanical Engineering

(Applicable for students admitted from the Academic Year 2024-25 and onwards)

5th Semester

Mechanical Engineering													
Sl. No.	**Course Code**	**Course Title**	**Course Type**	**TD/ PSB**	**Teaching Hours / Week**			**Examination**					
					L	**T**	**P**	**SEE Duration (Hrs)**	**CIE Marks**	**SEE Marks**	**Total Marks**	**Credits**
1	BME501	Management & Entrepreneurship	PCC	ME	3	0	0	**3**	**50**	**50**	**100**	**3**
2	BME502	Turbo Machines	IPCC	ME	3	0	2	**3**	**50**	**50**	**100**	**4**
3	BME503	Theory of Machines	PCC	ME	3	0	0	**3**	**50**	**50**	**100**	**4**
4	BMEL504	CNC Programming and 3-D Printing lab	PCCL	ME	0	0	2	**3**	**50**	**50**	**100**	**1**
5	BME525x	Professional Elective Course – I	PEC	ME	3	0	0	**3**	**50**	**50**	**100**	**3**
6	BME536	Mini Project	PROJ	ME	0	0	2	**3**	**100**	**-**	**100**	**2**
7	BRM507	Research Methodology and IPR	AEC	ME	2	2	0	**3**	**50**	**50**	**100**	**3**
8	BCE509	Competency Enhancement Course-3	NCMC	CDCAC	0	2	0	**-**	**100**	**-**	**100**	**0**
9	BNS510	National Service Scheme (NSS)	NCMC	NSS Coordinator	0	0	2	**-**	**100**	**-**	**100**	**0**
	BPE510	Physical Education (PE) (Sports and Athletics)		Physical Education Director								
	BYO510	Yoga		Yoga Teacher								
	BMU510	Music		Music Teacher								
									600	**300**	**900**	**20**

ASC: Applied Science Course, PCC: Professional Core Course, IPCC: Integrated Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, NCMC: Non Credit Mandatory Course, AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, ESC: Engineering Science Course, ETC: Emerging Technology Course, PLC: Programming Language Course, L: Lecture, T: Tutorial, P: Practical, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation.

Professional Elective Course – I

Course Code	Course Name	Course Code	Course Name
BME525A	Applied Mechatronics	BME525C	Supply chain management & Introduction to SAP
BME525B	Automation in Manufacturing	BME525D	Energy Engineering

Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical's of the same course. Credit for IPCC can be 04 and its Teaching– Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering (B.E.) 2024-25 may please be referred.

National Service Scheme /Physical Education/Yoga/Music: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), Yoga and Music with the concerned coordinator / teacher of the course during the first week of 3rd semester. Activities shall be carried out between 3rd semester to the 6th semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, Yoga and Music activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Semester:V						
Management & Entrepreneurship						
Course Code	**:**	BME501		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PCC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	**Communication English**
Knowledge on Fundamental Concepts	**NIL**
Knowledge on Connected Tools (If any)	**NIL**

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the fundamental concepts of management, including its nature, scope, and evolution, and apply the principles of planning and decision-making in organizational contexts.
CLO2	Analyze organizational structures, staffing processes, and leadership styles, and evaluate the role of coordination and control in effective management.
CLO3	Recognize the role of entrepreneurs in economic development, analyze the stages of the entrepreneurial process, and evaluate the challenges faced by entrepreneurs in India.
CLO4	Explain the significance of SSIs in economic development, assess government policies supporting SSIs, and analyze the impact of globalization/WTO on small-scale industries.
CLO5	Develop a project report by identifying business opportunities, conducting feasibility studies, and utilizing institutional support systems for entrepreneurial ventures.

Module – 1	**08 Hrs**
Management: Introduction Meaning nature and characteristics of Management, Scope and Functional areas of management Management as a science, art of profession Management & Administration Roles of Management, Levels of Management, Development of Management Thought Early management approaches – Modern management approaches. **Planning:** Nature, importance and purpose of planning process Objectives Types of plans (Meaning Only) Decision making Importance of planning steps in planning & planning premises Hierarchy of plans. **Text Book 1 : Ch 1 Text Book 2 : Ch 1 Text Book 5 : Ch 1**	
Module – 2	**08 Hrs**
Organizing and Staffing: Nature and purpose of organization Principles of organization Types of organization Departmentation Committees Centralization Vs Decentralization of authority and responsibility Span of control MBO and MBE (Meaning Only) Nature and importance of staffing Process of Selection & Recruitment (in brief).	

Directing & Controlling: Meaning and nature of directing Leadership styles, Motivation Theories, Communication Meaning and importance coordination, meaning and importance and Techniques of Co Ordination. Meaning and steps in controlling Essentials of a sound control system Methods of establishing control (in brief).

Text Book 1 :Ch 2 Text Book 2 :Ch 2 Text Book 4 :Ch 2

Module – 3	**08 Hrs**

Entrepreneur: Meaning of Entrepreneur; Evolution of the Concept; Functions of an Entrepreneur, Types of Entrepreneurs, Entrepreneur an emerging. Class. Concept of Entrepreneurship Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

Text Book 1 :Ch 3 Text Book 2 :Ch 3 Text Book 3 :Ch 3

Module – 4	**08 Hrs**

Small Scale Industries: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start and SSI Government policy towards SSI; Different Policies of SSI; Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GA TT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry

Text Book 1 :Ch 4 Text Book 2 :Ch 4 Text Book3 :Ch 4

Module – 5	**08 Hrs**

Institutional Support: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC.

Preparation of Project: Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study

Text Book 1 :Ch 5 Text Book 2 :Ch 5 Text Book 5 :Ch 5

Course Outcomes: After completing the course, the students will be able to	
CO1	**Apply** the basic principles and concepts of management and Distinguish different plans and steps in planning
CO2	**Understanding** the concepts of organizing and staffing and illustrate the concepts of directing and controlling
CO3	**Illustrate** the meaning, functions, types and roles of an entrepreneur and interpret the business ethics and social responsibilities of the business
CO4	**Elucidate** in detail about the modern small business enterprise and describe various institutional supports for SSI.
CO5	**Understanding** in detail about the Institutional support and explanation regarding the preparation of the project report,

Text Books	
1	Principles of Management, P. C.Tripathi,P.N. Reddy, Tata McGraw Hill,
2	Dynamics of Entrepreneurial Development & Management, Vasant Desai, Publishing House.
3	Entrepreneurship Development, Poornima. M.Charantimath, Small Business Enterprises – Pearson, 2006 (2 & 4).
4	Management Fundamentals Concepts, Application , Skill , RobersLusier –Thomson
5	Entrepreneurship Development, S.S.Khanka, S.Chand& Co 6. Management, Stephen Robbins, Pearson Education/PHI, 17th Edition, 2003.

Web links and Video Lectures (e-Resources)	
1	www.nptel.ac.in
2	https://onlinecourses.nptel.ac.in/noc23_mg74/preview
3	https://onlinecourses.nptel.ac.in/noc23_mg70/preview
4	https://cleartax.in/s/smallscaleindustriesssi#:~:text=Small%20Scale%20Industries%20(SSI)%20are,50%20crore

CO – PO MAPPING

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1								1				
CO2	1					1			2				
CO3	1					1			2	1			
CO4	1					1			1	2			
CO5	1					1			2	2	2		

Semester: V					
TURBO MACHINES					
Course Code	**:**	**BME502**	**Credits**	**:**	04
Hours/Week(L:T:P)	**:**	3:0:2	**CIE**	**:**	50 Marks
Total Hours	**:**	40 + 10 Lab Hours	**SEE**	**:**	50 Marks
Course Type	**:**	IPCC	**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	**Engineering Mathematics, Fluid Mechanics**
Knowledge on Fundamental Concepts	**Basic knowledge of fluid flow, thermodynamics, work, energy, power, rotational motion, velocity triangles, and energy transfer in rotating fluid machines.**
Knowledge on Connected Tools (If any)	**NIL**

Course Learning Objectives: This course will enable the students to	
CLO1	Understand typical design of Turbo machine, their working principle, application and thermodynamics process involved
CLO2	Study the conversion of fluid energy to mechanical energy in Turbo machine with utilization factor and degree of reaction.
CLO3	Analyze various designs of steam turbine and their working principle.
CL04	Study the various designs of hydraulic turbine based on the working principle
CL05	Understand the various aspects in design of power absorbing machine.

Module – 1	**08 Hrs.**
Introduction: Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Unit and specific quantities, model studies (Simple numerical on Model Studies). **Thermodynamics of fluid flow:** Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines, Static and Stagnation states, overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process. Simple Numerical on-stage efficiency and polytropic efficiency. **Textbook 1: Chapter 1**	
Module – 2	**08 Hrs.**
Energy exchange in Turbo machines: Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor, Problems. **General Analysis of Turbo machines:** Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction. Effect of blade discharge angle on performance, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Numerical Problems.	

Textbook 2: Chapter 2	
Module – 3	**08 Hrs.**

Steam Turbines: Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, multi-stage impulse turbine, expression for maximum utilization factor, Numerical.

Reaction turbine: Parsons's turbine, condition for maximum utilization factor, reaction staging. Numerical.

Textbook 1: Chapter 4

Module – 4	**08 Hrs.**

Hydraulic Turbines: Classification, various efficiencies. **Pelton Wheel** – Principle of working, velocity triangles, design parameters, maximum efficiency, and numerical.

Francis turbine – Principle of working, velocity triangles, design parameters, and numerical problems

Kaplan and Propeller turbines: Principle of working, velocity triangles, design parameters and Numerical. Theory and types of Draft tubes.

Textbook 2: Chapter 4

Module – 5	**08 Hrs.**

Centrifugal Pumps: Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Theoretical head – capacity relationship, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems.

Textbook 3: Chapter 7

PRACTICAL COMPONENT OF IPCC *(May cover all / major modules)*

Sl.NO	Experiments
1	Performance analysis of Pelton Wheel
2	Performance analysis of Francis turbine
3	Performance analysis of Kaplan turbine
4	Performance analysis of centrifugal blowers
5	Performance analysis of centrifugal pump.
6	Performance analysis of Axial Fan and Radial Fan

Course Outcomes: After completing the course, the students will be able to	
CO1	**Apply** the Model studies and thermodynamics analysis of turbo machines.
CO2	**Analyze** the energy transfers in Turbo machine with degree of reaction and utilization factor.
CO3	**Classify**, analyze and understand various type of steam turbine.
CO4	**Classify**, analyze and understand various type of hydraulic turbine.
CO5	**Understand** the concept of radial power absorbing machine and the problems involved during its operation.

Text Books	
1	V. Kadambi and Manohar Prasad, An Introduction to Energy Conversion, Volume III, Turbo machinery, New Age International Publishers, reprint 2008
2	M. S. Govinde Gowda, A Text of Turbo machines, 1st Edn, 2024, Iterative International Publishers (IIP), ISBN: 978-93-6252-884-1.
3	Principals of Turbo machines, D. G. Shepherd, The Macmillan Company (1964).

Reference Books	
1	Fluid Mechanics & Thermodynamics of Turbo machines, S. L. Dixon, Elsevier (2005).
2	Turbines, Compressors & Fans, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002.

Web links and Video Lectures (e-Resources)	
1	https://www.tlv.com/global/TI/steam-theory/principal-applications-for-steam.html
2	https://www.turboindustries.com/
3	https://www.aeroprobe.com/turbomachinery-industry/
4	https://www.mr-cfd.com/industries/turbomachinery/
5	https://youtu.be/GIvV6XWaG-A

CO – PO MAPPING

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3	3	3	2	-	-	-	-	1	-	-	3	3
CO2	3	3	3	2	-	-	-	-	1	-	-	3	3
CO3	3	3	3	-	-	-	-	-	-	-	-	3	3
CO4	3	3	3	-	-	-	-	-	-	-	-	3	3
CO5	3	3	3	-	-	-	-	-	-	-	-	3	3

Semester: V						
Theory of Machines						
Course Code	**:**	**BME503**		**Credits**	**:**	04
Hours/Week(L:T:P)	**:**	3:2:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PCC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	**Engineering Mechanics**
Knowledge on Fundamental Concepts	**Mechanics**
Knowledge on Connected Tools (If any)	**NIL**

Course Learning Objectives: This course will enable the students to	
CLO1	Understand the concept of machines, mechanisms and to analyze a mechanism for displacement, velocity and acceleration at any point in a moving link.
CLO2	Determine the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
CLO3	Understand the principles in gears, gear trains and mechanisms used for speed control and stability control devices.
CLO4	Compute the natural and damped frequencies for 1DOF mechanical systems and analyze the system subjected to harmonic excitation conditions.

Module – 1	**08 Hrs**
Introduction: Mechanisms and machines, Kinematic pairstypes, degree of freedom, Kinematic chains and their classification, Kinematic inversions. **Velocity and Acceleration analysis of planar mechanisms Graphical method:** Velocity and Acceleration Analysis of Mechanisms Velocity and acceleration analysis of four bar mechanism, slider crank mechanism. Mechanism illustrating Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing. **Velocity and Acceleration Analysis of Mechanisms (Analytical Method):** Velocity and acceleration analysis of four bar mechanism, slider crank mechanism using complex algebra method. **Textbook-1: Chapter 1 Textbook-2: Chapter 1**	
Module – 2	**08 Hrs**

Static force analysis: Static equilibrium, analysis of four bar mechanism, slider crank mechanism.

Dynamic force analysis: D'Alembert's principle, analysis of four bar and slider crank mechanism.

Flywheel: Introduction to Flywheel and calculation of its size for simple machines like punching machine, shearing machine.

Textbook-1: Chapter 2 Textbook-2: Chapter 2

Module – 3	**08 Hrs**

Spur Gears: Gear terminology, law of gearing, path of contact, arc of contact, contact ratio of spur gear. Interference in involute gears, methods of avoiding interference, condition and expressions for minimum number of teeth to avoid interference.

Gear Trains: Simple gear trains, compound gear trains. Epicyclic gear trains: Algebraic and tabular methods of finding velocity ratio of Epicyclic gear trains, torque calculation in epicyclic gear trains. Discussions on applications of gear trains.

Textbook-1: Chapter 3

Module – 4	**08 Hrs**

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. Discussions on applications.

Balancing of Reciprocating Masses: Inertia Effect of crank and connecting rod, Single cylinder Engine, Balancing in multi cylinderinline engine (primary and secondary forces). Discussions on applications.

Governors: Types of Governors; Force Analysis of Porter and Hartnell Governors. Controlling Force, Stability, Sensitiveness, Isochronism, Effort and Power. Discussion on applications.

Textbook-1: Chapter 4 Textbook-2: Chapter 4

Module – 5	**08 Hrs**

Free vibrations: Basic elements of vibrating system, Types of free vibrations, Longitudinal vibrations Equilibrium method, D'Alembert's principle, Determination of natural frequency of single degree freedom systems, Damped free vibrations: Under damped, over damped and critically damped systems. Logarithmic decrement.

Forced vibrations: Undamped forced vibration of spring mass system damped forced vibrations, rotating unbalance, Reciprocating unbalance, Vibration isolation, Critical speed. Discussions on applications.

Textbook-1: Chapter 5

Course Outcomes: After completing the course, the students will be able to

CO1	**Elucidate** different types of mechanisms and their principles, to convert available motion into desired/constrained motions.
CO2	**Determine** kinematic relative motions (Displacement, Velocity and Accelerations), forces and moments induced in different parts of mechanisms.
CO3	**Explore** the different types of gears, gear trains and their working principles.
CO4	**Analyze** the system subjected to unwanted inertial forces and make them to stabilize.
CO5	**Identify** reasons of systems undergo vibration and to avoid Resonance condition.

Text Books	
1	Theory of Machines Rattan S.S Tata McGrawHill Publishing Company 2014
2	Theory of Machines Kinematics and Dynamics Sadhu Singh Pearson Third edition 2019

Reference Books	
1	Mechanism and Machine Theory G. Ambekar PHI 2009 Reference Books
2	Mechanisms and Machines Kinematics, Dynamics and Synthesis Michael M Stanisic Cengage Learning 2016
3	Machines and Mechanisms David H. Myszka, 2012, Prentice Hall

Web links and Video Lectures (e-Resources)	
1	nptel.ac.in/courses/112105268
2	https://archive.nptel.ac.in/courses/112/106/112106270/
3	https://archive.nptel.ac.in/courses/112/104/112104121/

CO – PO MAPPING

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3								3	3		3	3
CO2	3	3	2						3	2		2	3
CO3	3								3	2		2	3
CO4	3	3	2						3	3		3	3
CO5	3	3	3						3	3		3	3

Semester: V						
CNC Programming and Additive Manufacturing Lab						
Course Code	**:**	**BMEL504**		**Credits**	**:**	01
Hours/Week(L:T:P)	**:**	0:0:2		**CIE**	**:**	50 Marks
Total Hours	**:**	24		**SEE**	**:**	50 Marks
Course Type	**:**	PCCL		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	**Manufacturing Technology, Machining Science**
Knowledge on Fundamental Concepts	**Milling Operations, Drilling Operations and Turning Operations**
Knowledge on Connected Tools (If any)	**Nil**

Course Learning Objectives: This course will enable the students to	
CLO1	To expose the students to the techniques of CNC programming and cutting tool path generation through CNC simulation software by using GCodes and Mcodes.
CLO2	To educate the students on the usage of CAM packages.
CLO3	To expose the students on the usage of 3D Printing Technology
CLO4	To make the students understand the importance of automation in industries through exposure to FMS,
CLO5	Robotics, and Hydraulics and Pneumatics.

Sl. No.	**Experiments**
1	Manual CNC part programming using ISO Format G/M codes for 3 milling parts. Selection and assignment of tools, correction of syntax and logical errors, and verification of tool path using CNC program verification software.
2	Manual CNC part programming using ISO Format G/M codes for 3 drilling parts. Selection and assignment of tools, correction of syntax and logical errors, and verification of tool path using CNC program verification software.
3	Manual CNC part programming using ISO Format G/M codes for 3 turning parts. Selection and assignment of tools, correction of syntax and logical errors, and verification of tool path using CNC program verification software.
4	CNC part programming using CAM packages : Simulation of Milling, Drilling and Turning simulations to be carried out using simulation packages like: Cadem CAMLabPro, MasterCAM.

5	Simple 3D Printing Model : Creating Simple 3D model (example cube, gear, prism etc) in CAD software and printing the model using any 3D Printer (FDM/SLA/SLS printer)
Demonstration Experiments (For CIE)	
6	Robot programming: Using Teach Pendent & Offline programming to perform pick and place, stacking of objects (2 programs).
7	Pneumatics and Hydraulics, ElectroPneumatics: 3 typical experiments on Basics of these topics to be conducted.
8	FMS (Flexible Manufacturing System): Programming of Automatic storage and Retrieval system (ASRS) and linear shuttle conveyor Interfacing CNC lathe, milling with loading unloading arm and ASRS to be carried out on simple components.

Course Outcomes: After completing the course, the students will be able to	
CO1	**Understand** and relate the concepts and components of computer integrated manufacturing (CIM) and computer Aided Manufacturing (CAM) to practical challenges.
CO2	**Demonstrate** the knowledge of computer numerical control (CNC) and CNC programming.
CO3	**Use** commercial CAD/CAM software to process product models.
CO4	**Demonstrate** the knowledge of the operation of CNC machines and 3D Printers.
CO5	**Apply** the concepts of Flexible Manufacturing Systems and Group Technology in the automated industrial sectors.

Text Books	
1	Automation, Production Systems and ComputerIntegrated Manufacturing, by Mikell P Groover, 3rd Edition, 2009, PHI Learning.
2	Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 2nd Ed. (2015), Ian Gibson, David W. Rosen, Brent Stucker 98
3	"Understanding Additive Manufacturing", Andreas Gebhardt, Hanser Publishers, 2011

Reference Books	
1	Systems Approach to ComputerIntegrated Design and Manufacturing by Dr. Nanua Singh,Wiley, 1996.
2	CAD/CAM/CIM P. Radhakrishnan, S. Subramanyan, U. Raju, New Age International Publication Revised Third Edition 2007. Delhi.

Web links and Video Lectures (e-Resources)	
1	https://www.youtube.com/watch?v=RCie2GrL6JM&list=PLLQ8y6Kbq78u_DZxA3hJIRksKKQwWOFPB
2	https://www.youtube.com/watch?v=B7MM5M7DzpM
3	https://www.youtube.com/watch?v=_5r2XR1h1aQ
4	https://www.youtube.com/watch?v=t7yv4gSnNkE&list=PLwdnzlV3ogoWI8QEu4hsT-n_r8UbWbquy

CO – PO MAPPING

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	3												
CO2	3				3								
CO3	2				3								
CO4	2				3								

Semester: V						
Applied Mechatronics						
Course Code	**:**	**BME525A**		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 hours Theory + 8-10 Lab slots		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	**NIL**
Knowledge on Fundamental Concepts	**NIL**
Knowledge on Connected Tools (If any)	**NIL**

Course Learning Objectives: This course will enable the students to	
CLO1	To acquire a strong foundation in science and focus in mechanical, electronics, control, software, and computer engineering, and a solid command of the newest technologies.
CLO2	To understand the evolution and development of Mechatronics as a discipline.
CLO3	To substantiate the need for interdisciplinary study in technology education.
CLO4	To understand the applications of microprocessors in various systems and to know the functions of each element.
CLO5	To demonstrate the integration philosophy in view of Mechatronics technology.

Module – 1	**08 Hrs**
Introduction: Scope and elements of Mechatronics, Mechatronics design process, measurement system, requirements and types of control systems, feedback principle, Basic elements of feedback control systems, Classification of control system. Examples of Mechatronics Systems such as Automatic Car Park system, Engine management system, Antilock braking system (ABS) control, Automatic washing machine. **Transducers and sensors**: Definition and classification of transducers, Difference between transducer and sensor, Definition and classification of sensors, Principle of working and applications of light sensors, Potentiometers, LVDT, Capacitance sensors, force and pressure sensors, Strain gauges, temperature sensors, proximity switches and Hall Effect sensors. **Textbook-1: Chapter1,2 Textbook-2: Chapter1**	
Module – 2	**08 Hrs**
Signal Conditioning: Introduction – Hardware –Digital I/O, Analog to digital conversions, resolution, Filtering Noise using passive components – Registers, capacitors, amplifying signals using OP amps. Digital Signal Processing – Digital to Analog conversion, Low pass, high pass, notch filtering. Data acquisition systems DAQS), data loggers, Supervisory control and data acquisition (SCADA), Communication methods. **Electro Mechanical Drives**: Relays and Solenoids – Stepper Motors – DC brushed motors – DC brushless motors – DC servo motors – 4quadrant servo drives, PWM's – Pulse Width	

Modulation. **Textbook-1: Chapter 3,4 Textbook-3: Chapter 3,4**
Module – 3 **08 Hrs**
Microprocessor & Microcontrollers: Introduction, Microprocessor systems, Basic elements of control systems, Microcontrollers, Difference between Microprocessor and Microcontrollers. Microprocessor Architecture: Microprocessor architecture and terminology-CPU, memory and address, I/O and Peripheral devices, ALU, Instruction and Program, Assembler, Data Registers, Program Counter, Flags, Fetch cycle, write cycle, state, bus interrupts. Intel's 8085A Microprocessor. **Textbook-1: Chapter5,6**
Module – 4 **08 Hrs**
Programmable Logic Controller: Introduction to PLCs, Basic structure of PLC, Principle of operation, input and output processing, PLC programming language, ladder diagram, ladder diagrams circuits, timer counters, internal relays, master control, jump control, shift registers, data handling, and manipulations, analogue input and output, selection of PLC for application. **Application of PLC control:** Extending and retracting a pneumatic piston using latches, control of two pneumatic pistons, control of process motor, control of vibrating machine, control of process tank, control of conveyer motor etc. **Textbook-1: Chapter5 Textbook-2: Chapter5**
Module – 5 **08 Hrs**
Mechatronics in Computer Numerical Control (CNC) machines: Design of modern CNC machines – Machine Elements: Different types of guide ways, Linear Motion guide ways. Bearings: anti friction bearings, hydrostatic bearing and hydrodynamic bearing. Recirculating ball screws. Typical elements of open and closed loop control systems. Adaptive controllers for machine tools. **Mechatronics Design process**: Stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Automatic car park barrier. **Textbook-1: Chapter6 Textbook-2: Chapter6**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Illustrate** various components of Mechatronics systems.
CO2	**Assess** various control systems used in automation.
CO3	**Design** and conduct experiments to evaluate the performance of a Mechatronics system or Component with respect to specifications, as well as to analyze and interpret data.
CO4	**Apply** the principles of Mechatronics design to product design.
CO5	**Function** effectively as members of multidisciplinary teams.

Text Books	
1	Mechatronics System Design by Devdas Shetty and Richard A Kolk, Second edition, Thomson Learning Publishing Company, Vikas publishing house, 2001.
2	W. Bolton, "Mechatronics" Addison Wesley Longman Publication, 1999.
3	Shetty and Kolk "Mechatronics System Design" Cengage Learning, 2010

Web links and Video Lectures (e-Resources)	
1	NPTEL course on Mechatronics (https://onlinecourses.nptel.ac.in/noc25_me91/preview)
2	Videos on Mechatronics

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning	
1	Quiz
2	Presentations
3	Group Activity

CO – PO MAPPING

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1		1		2	1			-	1	1	2
CO2	2	1	1			1			1	1		2
CO3	1	2	1	2	1	1			2	2	-	1
CO4	1	1	2	2	1	1			1	1	1	1
CO5	1		1			1			2	2		

Semester: V						
Automation in Manufacturing						
Course Code	**:**	**BME525B**		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40 hours Theory + 8-10 Lab slots		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	**NIL**
Knowledge on Fundamental Concepts	**NIL**
Knowledge on Connected Tools (If any)	**NIL**

Course Learning Objectives: This course will enable the students to	
CLO1	Explain the basics of productions, automation system and manufacturing operations.
CLO2	Solve the simple problems on mathematical model.
CLO3	Explain CAPP and MRP system and analyze the AGVS.
CLO4	Understand the inspection technologies and shop floor control.
CLO5	Explain the modern trends in additive manufacturing and automated factory

Module – 1	**08 Hrs**
Introduction: Production system facilities, Manufacturing support systems, Automation in production systems, Automation principles &strategies Manufacturing Operations: Manufacturing operations, Product/production relationship, Production concepts and Mathematical models &costs of manufacturing operations. Problems on mathematical models. **Text Book-1: Ch 1, Text Book-2: Ch 1, Ch 2, Ch 3**	
Module – 2	**08 Hrs**
Line Balancing: Methods of line balancing, Numerical problems on largest candidate rule, Kilbridge's and Wester's method, and ranked positional weights method, computerized line balancing methods. Automated Assembly System: Design for automated assembly, types of automated assembly system, Parts feeding devices, Analysis of single and multi station assembly machines. **Text Book-1: Ch 2, Text Book-3: Ch 2**	
Module – 3	**08 Hrs**
Computerized Manufacture Planning and AGVS: Computer aided process planning (CAPP), Retrieval and Generative systems, and benefits of CAPP. Material requirement planning, Inputs to MRP system, working of MRP, Outputs and benefits. Automated Guided Vehicles System: Applications, Guidance and routing, Industrial Robotics: Definition, Robot anatomy,	

Joints and links, Robot configurations, Robot control systems, Accuracy and repeatability, End effectors, Sensors in robotics. Industrial robot applications: Material handling, Processing, assembly and inspection.

Text Book-1: Ch 3, Text Book-3: Ch 3

Module – 4	**08 Hrs**

Inspection Technologies: Automated inspection, coordinate measuring machines construction, Operation &programming, Software, application &benefits, Flexible inspection system, Inspection probes on machine tools, Machine vision, Optical inspection techniques & Noncontact Non-optical inspection technologies. Shop Floor Control and Automatic Identification Techniques: Shop floor control, Factory data collection system, Automatic identification methods, Bar code technology, Automatic data collection systems. An Introduction to QR Code Technology.

Text Book-1: Ch 4, Text Book-3: Ch 4

Module – 5	**08 Hrs**

Additive Manufacturing Systems: Basic principles of additive manufacturing, Slicing CAD models for AM, Advantages and limitations of AM technologies, Recent trends in manufacturing, Hybrid manufacturing. Future of Automated Factory: Trends in manufacturing, the future automated factory, Human workers in future automated factory, Social impact.

Text Book-1: Ch 5, Text Book-2: Ch 5

Course Outcomes: After completing the course, the students will be able to	
CO1	Explain the basics of productions, automation system and manufacturing operations. Solve the simple problems on mathematical model.
CO2	Can analyze the methods of line balancing.
CO3	Explain CAPP and MRP system and analyze the AGVS.
CO4	Understand the inspection technologies and shop floor control.
CO5	Explain the modern trends in additive manufacturing and automated factory.

Text Books	
1	Automation, Production Systems and Computer Integrated Manufacturing, by Mikell P Groover, 3rd Edition, 2009, PHI Learning.
2	Automation, Production Systems and Computer Integrated Manufacturing, by Mikell P Groover, 1999, Prentice Hall of India.
3	CAD / CAM Principles and Applications by P N Rao, 3rd Edition, 2015, Tata McGraw Hill.

Reference Books	
1	Systems Approach to Computer Integrated Design and Manufacturing by Dr. Nanua Singh,Wiley, 1996.
2	CAD/CAM/CIM P. Radhakrishnan, S. Subramanyan, U. Raju, New Age International Publication Revised Third Edition 2007. Delhi.

Web links and Video Lectures (e-Resources)	
1	http://lavalle.pl/vr/book.html
2	https://nptel.ac.in/courses/106/106/106106138/
3	https://www.coursera.org/learn/introduction-virtual-reality.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning	
1	Quiz
2	Presentations
3	Group Activity

CO – PO MAPPING

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	1	1		1	1				1	1	
CO2	1	2		2	1				1	1	
CO3	1		1		1	1			1		
CO4	1	2		2	1	1			1	2	
CO5	1		2		3	1			2	1	

Semester: V						
Supply Chain Management & Introduction to SAP						
Course Code	**:**	**BME525C**		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	**NIL**
Knowledge on Fundamental Concepts	**NIL**
Knowledge on Connected Tools (If any)	**NIL**

Course Learning Objectives: This course will enable the students to	
CLO1	To acquaint with key drivers of supply chain performance and their inter-relationships with strategy.
CLO2	To impart analytical and problem-solving skills necessary to develop solutions for a variety of supply chain management & design problems.
CLO3	To study the complexity of inter-firm and intra-firm coordination in implementing programs such as e-collaboration, quick response, jointly managed inventories and strategic alliances.
CLO4	To understand the usage of SAP material management system

Module – 1	**08 Hrs**
Introduction: Supply Chain – Fundamentals –Evolution- Role in Economy - Importance - Decision Phases –Supplier Manufacturer-Customer chain. - Enablers/ Drivers of Supply Chain Performance. Supply chain strategy -Supply Chain Performance Measures. **Strategic Sourcing Outsourcing** – Make Vs buy - Identifying core processes - Market Vs Hierarchy - Make Vs buy continuum -Sourcing strategy - Supplier Selection and Contract Negotiation. **Textbook-1: Chapter 1,2**	
Module – 2	**08 Hrs**
Warehouse Management Stores management - stores systems and procedures-incoming materials control stores accounting and stock verification Obsolete, surplus and scrap-value analysis-material handling transportation and traffic management - operational efficiency - productivity-cost effectiveness-performance measurement. **Supply Chain Network Distribution Network Design** – Role - Factors Influencing Options, Value Addition – Distribution Strategies - Models for Facility Location and Capacity allocation. Distribution Center Location Models. **Textbook-1: Chapter 3,4 Textbook-3: Chapter 3**	
Module – 3	**08 Hrs**
Supply Chain Network optimization models- Impact of uncertainty on Network Design - Network Design, decisions using Decision trees. Planning Demand,	

-multiple item -multiple location inventory management. Pricing and Revenue Management. **Textbook-1: Chapter 5 Textbook-4: Chapter 4**
Module – 4 **08 Hrs**
Current Trends: Supply Chain Integration - Building partnership and trust in Supply chain Value of Information: Bullwhip Effect - Effective forecasting - Coordinating the supply chain. Supply Chain restructuring, Supply Chain Mapping - Supply Chain process restructuring, Postpone the point of differentiation – IT in Supply Chain - Agile Supply Chain -Reverse Supply chain. Future of IT in supply chain- EBusiness in supply chain. **Textbook-2: Chapter 4 Textbook-2: Chapter 5**
Module – 5 **08 Hrs**
Introduction to SAP - SAP Material Management, Procurement process, Organization structure, Enterprise structure, Master data management, purchase Info record, source list, procurement cycle, purchase requisition, request for quotation, purchase order, inventory management, invoice verification, service management, transaction code **Textbook-1: Chapter 6 Textbook-3: Chapter 5**

Course Outcomes: After completing the course, the students will be able to	
CO1	**Understand** To understand the usage of SAP material management system
CO2	**Identify** Build and manage a competitive supply chain using strategies, models, techniques and information technology
CO3	**Apply** Plan the demand, inventory and supply and optimize supply chain network.
CO4	**Describe** Illustrate the emerging trends and impact of IT on Supply chain.
CO5	**Summarize** Apply the basics of SAP material management system

Text Books	
1	Janat Shah, Supply Chain Management– Text and Cases, Pearson Education, 2nd edition
2	Sunil Chopra and Peter Meindl, Supply Chain Management-Strategy Planning and Operation, PHI Learning /Pearson Education, 6th edition.
3	David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Designing and Managing the Supply Chain: Concepts, Strategies, and Cases, Tata McGraw-Hill.
4	Ballou Ronald H, Business Logistics and Supply Chain Management, Pearson Education

Web links and Video Lectures (e-Resources)	
1	https://onlinecourses.nptel.ac.in/noc21_mg45/preview
2	https://nptel.ac.in/courses/110106045

3	https://www.udemy.com/course/sap-mm-training/
4	https://www.udemy.com/course/sap-s4hana-mm-sourcing-and-procurement/
5	https://nptel.ac.in/courses/110105095.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning	
1	Case study of companies' example Amazon, Flipkart, Parle, DMart, Reliance etc can be discussed.

CO – PO MAPPING

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1										3		
CO2	2				2						3		
CO3	1				1						3		
CO4	1				3						3		
CO5	1				3						3		

Semester-V						
Energy Engineering						
Course Code	**:**	**BME525D**		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	PEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	**Fundamentals of Mechanical Engineering**
Knowledge on Fundamental Concepts	**NIL**
Knowledge on Connected Tools (If any)	**NIL**

Course Learning Objectives: This course will enable the students to	
CLO1	Understand energy scenario, energy sources and their utilization
CLO2	Learn about energy conversion method
CLO3	Study the principles of renewable energy conversion systems

Module – 1	**08 Hrs**
STEAM GENERATORS Coal and ash handling, Generation of steam using forced circulation, high and supercritical pressures, LaMount, Benson, Velox, Loeffer, Schmidt steam generators, Cooling towers and Ponds, Accessories such as Superheaters, De-superheater, Economizers, Air preheaters. **Textbook-1: Chapter 1,2**	
Module – 2	**08 Hrs**
Solar Energy: Introduction, Solar radiation at the earth's surface, Solar radiation measurements, Flat plate collectors, Focussing collectors, Solar pond, Solar electric power generation-Solar photovoltaic. **Biomass Energy**: Photosynthesis, photosynthetic oxygen production, energy plantation. Bio Chemical Route: Biogas production from organic wastes by anaerobic fermentation, Bio gas plants-KVIC, Janta, Deenbhandu models, factors affecting bio gas generation. Thermal gasification of biomass, updraft and downdraft. **Textbook-1: Chapter 3,4 Textbook-3: Chapter 3**	
Module – 3	**08 Hrs**
Geothermal Energy: Forms of geothermal energy, Dry steam, wet steam, hot dry rock and magmatic chamber systems. **Tidal Energy**: Tidal power, Site selection, Single basin and double basin systems, Advantages and disadvantages of tidal energy. **Wind Energy**: Wind energy-Advantages and limitations, wind velocity and wind power, Basic components of wind energy conversion systems, horizontal and vertical axis wind mills, coefficient of performance of a wind mill rotor, Applications of wind energy. **Textbook-1: Chapter 5 Textbook-4: Chapter 4**	

Module – 4	08 Hrs
Hydroelectric plants: Advantages & disadvantages of water power, Hydrographs and flow duration curves- numericals, Storage and pondage, General layout of hydel power plants- components such as Penstock, surge tanks, spill way and draft tube and their applications, pumped storage plants, Detailed classification of hydroelectric plants, water hammer. **Ocean Thermal Energy**: Ocean thermal energy conversion, Principle and working of Rankine cycle, Problems Associated with OTEC. **Textbook-2: Chapter 4 Textbook-3: Chapter 5**	
Module – 5	**08 Hrs**
NUCLEAR ENERGY Principles of release of nuclear energy-Fusion and fission reactions. Nuclear fuels used in the reactors, Chain reaction, Moderation, breeding, Multiplication and thermal utilization factors. General components of a nuclear reactor and materials, Brief description-Pressurized water reactor, Boiling water reactor, Sodium graphite reactor, Fast Breeder reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Shielding, Nuclear waste, Radioactive waste disposal. **Textbook-1: Chapter 6 Textbook-3: Chapter 5**	

Course Outcomes: After completing the course, the students will be able to	
CO1	Understand the construction and working of steam generators and their accessories.
CO2	Identify renewable energy sources and their utilization
CO3	Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, nuclear, hydel and tidal.

Text Books	
1	Power Plant Engineering, P. K. Nag, Tata McGraw Hill Education Private Limited, New Delhi,
2	Power Plant Engineering, Arora and Domkundwar, Dhanpat Rai & Co. (P) Ltd.
3	Non-conventional Sources of Energy, G.D.Rai, Khanna Publishers, New Delhi
4	Power Plant Engineering, R. K. Rajput, Laxmi publication New Delhi

CO – PO MAPPING

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	1		1								1		
CO2	2				1			1			2		
CO3	1		1		1						1		
CO4	1				1						2		
CO5	1				3						2		

Semester: V						
RESEARCH METHODOLOGY AND IPR						
Course Code	**:**	**BRM507**		**Credits**	**:**	03
Hours/Week(L:T:P)	**:**	3:0:0		**CIE**	**:**	50 Marks
Total Hours	**:**	40		**SEE**	**:**	50 Marks
Course Type	**:**	AEC		**SEE Duration**	**:**	3 Hours

Prerequisites:	
Courses	**NIL**
Knowledge on Fundamental Concepts	**NIL**
Knowledge on Connected Tools (If any)	**NIL**

Course Learning Objectives: This course will enable the students to	
CLO1	To Understand the knowledge on basics of research and its types.
CLO2	To Learn the concept of Literature Review, Technical Reading, Attributions and Citations.
CLO3	To learn Ethics in Engineering Research.
CLO4	To Discuss the concepts of Intellectual Property Rights in engineering

Module – 1	**08 Hrs**
Introduction: Meaning of Research, Objectives of Engineering Research, and Motivation in Engineering Research, Types of Engineering Research, Finding and Solving a Worthwhile Problem. Ethics in Engineering Research, Ethics in Engineering Research Practice, Types of Research Misconduct, Ethical Issues Related to Authorship. **Textbook-1: Chapter 1 Reference book-1: Chapter 1**	
Module – 2	**08 Hrs**
Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art Bibliographic Databases, Web of Science, Google and Google Scholar, Effective Search: The Way Forward Introduction to Technical Reading Conceptualizing Research, Critical and Creative Reading, Taking Notes While Reading, Reading Mathematics and Algorithms, Reading a Datasheet. **Attributions and Citations**: Giving Credit Wherever Due, Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge Flow through Citation, Citing Datasets, Styles for Citations, Acknowledgments and Attributions, What Should Be Acknowledged, Acknowledgments in, Books Dissertations, Dedication or Acknowledgments. **Textbook-1: Chapter 2 Reference book-1: Chapter 2**	
Module – 3	**08 Hrs**
Introduction To Intellectual Property: Role of IP in the Economic and Cultural Development of the Society, IP Governance, IP as a Global Indicator of Innovation, Origin of IP History of IP in India. Major Amendments in IP Laws and Acts in India.	

Patents: Conditions for Obtaining a Patent Protection, To Patent or Not to Patent an Invention. Rights Associated with Patents. Enforcement of Patent Rights. Inventions Eligible for Patenting. Non-Patentable Matters. Patent Infringements. Avoid Public Disclosure of an Invention before Patenting. Process of Patenting.

Process of Patenting. Prior Art Search. Choice of Application to be Filed. Patent Application Forms. Jurisdiction of Filing Patent Application. Publication. Pre-grant Opposition. Examination. Grant of a Patent. Validity of Patent Protection. Post-grant Opposition. Commercialization of a Patent. Need for a Patent Attorney/Agent. Can a Worldwide Patent be Obtained? Do I Need First to File a Patent in India? Patent Related Forms. Fee Structure. Types of Patent Applications. Commonly Used Terms in Patenting. National Bodies Dealing with Patent Affairs. Utility Models.

Textbook-1: Chapter 3 Reference book-2: Chapter 3

Module – 4	**08 Hrs**

Copyrights and Related Rights: Classes of Copyrights. Criteria for Copyright. Ownership of Copyright. Copyrights of the Author. Copyright Infringements. Copyright Infringement is a Criminal Offence. Copyright Infringement is a Cognizable Offence. Fair Use Doctrine. Copyrights and Internet. Non-Copyright Work. Copyright Registration. Judicial Powers of the Registrar of Copyrights. Fee Structure. Copyright Symbol. Validity of Copyright. Copyright Profile of India. Copyright and the word 'Publish'. Transfer of Copyrights to a Publisher. Copyrights and the Word 'Adaptation'. Copyrights and the Word 'Indian Work'. Joint Authorship. Copyright Society. Copyright Board. Copyright Enforcement Advisory Council (CEAC). International Copyright Agreements, Conventions and Treaties. Interesting Copyrights Cases.

Trademarks: Eligibility Criteria. Who Can Apply for a Trademark. Acts and Laws. Designation of Trademark Symbols. Classification of Trademarks. Registration of a Trademark is Not Compulsory. Validity of Trademark. Types of Trademark Registered in India. Trademark Registry. Process for Trademarks Registration. Prior Art Search. Famous Case Law: Coca-Cola Company vs. Bisleri International Pvt. Ltd.

Textbook-1: Chapter 4 Reference book-1: Chapter 4

Module – 5	**08 Hrs**

Industrial Designs: Eligibility Criteria. Acts and Laws to Govern Industrial Designs. Design Rights. Enforcement of Design Rights. Non-Protectable Industrial Designs India. Protection Term. Procedure for Registration of Industrial Designs. Prior Art Search. Application for Registration. Duration of the Registration of a Design. Importance of Design Registration. Cancellation of the Registered Design. Application Forms.

Classification of Industrial Designs. Designs Registration Trend in India. International Treaties. Famous Case Law: Apple Inc. vs. Samsung Electronics Co.

Geographical Indications: Acts, Laws and Rules Pertaining to GI. Ownership of GI. Rights Granted to the Holders. Registered GI in India. Identification of Registered GI. Classes of GI. Non-Registerable GI. Protection of GI. Collective or Certification Marks. Enforcement of GI Rights. Procedure for GI Registration Documents Required for GI Registration. GI Ecosystem in India.

Case Studies on Patents. Case study of Curcuma (Turmeric) Patent, Case study of Neem Patent, Case study of Basmati patent. **IP Organizations In India. Schemes and Programmes**

Textbook-1: Chapter 5 Reference book-2: Chapter 5

Course Outcomes: After completing the course, the students will be able to	
CO1	To know the meaning of engineering research.
CO2	To know the procedure of the literature Review and Technical Reading
CO3	To understand the fundamentals of the patent laws and drafting procedure
CO4	Understanding the copyright laws and subject matters of copyrights and designs
CO5	Understanding the basic principles of design rights

Text Books	
1	Dr. Santosh M Nejakar, Dr. Harish Bendigeri "Research Methodology and Intellectual Property Rights", ISBN 978-93-5987-928-4, Edition: 2023-24.

Reference Books	
1	David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488-4
2	Intellectual Property Rights by N.K.Acharya Asia Law House 6th Edition. ISBN: 978-93-81849-30-9

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning	
1	Quizzes
2	Assignments
3	Seminars

CO – PO MAPPING

COURSE OUTCOMES	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	2	2	1	2				3		1	2		
CO2	2	3	1	1	1			2		2	1		
CO3	2	2			1	1				1	1		
CO4	2	2				2		2			1		
CO5	2	2				1		2			1		

Institute Vision

Preparing Competent Engineering and Management Professionals to Serve the Society

Institute Mission

- Providing Students with a Sound Knowledge in Fundamentals of their branch of Study.
- Promoting Excellence in Teaching, Training, Research and Consultancy.
- Exposing Students to Emerging Frontiers in various domains enabling Continuous Learning.
- Developing Entrepreneurial acumen to venture into Innovative areas.
- Imparting Value based Professional Education with a sense of Social Responsibility.

Department Vision

Building Technically Competent Engineers to Serve the Society

Department Mission

- Imparting strong fundamental knowledge in Mechanical Engineering and allied fields.
- Fostering a culture of collaboration and propagating Industry institute interactions to enhance advances in latest technologies.
- Creating State-of-Art facilities benefitting students and faculty to carryout Research, Innovation and Consultancy.
- Providing conducive environment for both students and faculty to engage in lifelong learning activities.
- Inculcating Professional ethics, Leadership qualities and Entrepreneurial skills among students.

SJC INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU from 2024-25

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