NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
(AN AUTONOMOUS INSTITUTE)

Affiliated to

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY, LUCKNOW

Evaluation Scheme & Syllabus

For

Bachelor of Technology

Mechanical Engineering

Third Year

(Effective from the Session: 2025-26)

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
(AN AUTONOMOUS INSTITUTE)

Bachelor of Technology
Mechanical Engineering

Evaluation Scheme
SEMESTER-V

Sl. No.	Subject Codes	Subject	Types of Subjects	Periods		Evaluation Schemes					End Semester		Total	Credit
				L	T	P	CT	TA	TOTAL	PS	TE	PE		
1	BCSCC0501	Design Thinking - II	Mandatory	2	1	0	30	20	50		100		150	3
2	BME0501	Theory of Machines	Mandatory	3	1	0	30	20	50		100		150	4
3		Department Elective-I	Department Elective	3	0	0	30	20	50		100		150	3
4		Department Elective-II	Department Elective	3	0	0	30	20	50		100		150	3
5	BME0552	Augmented Reality & Virtual Reality	Mandatory	0	0	6				50		100	150	3
6	BME0553	Automotive Mechatronics	Mandatory	0	0	6				50		100	150	3
7	BME0551	Theory of Machines Lab	Mandatory	0	0	4				50		50	100	2
8	BME0559	Internship Assessment - II	Mandatory	0	0	2				50			50	1
9	BNC0502/ BNC0501	Essence of Indian Traditional Knowledge/ Constitution of India	Mandatory	2	0	0	30	20	50		50		100	NA
10		*Massive Open Online Courses (For B.Tech. Hons. Degree)												
		TOTAL		**13**	**2**	**18**	**120**	**80**	**200**	**200**	**400**	**250**	**1050**	**22**

*** List of MOOCs Based Recommended Courses for Second year (Semester-V) B. Tech Students**

Sr. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	BMC0071	CAD automation using CATIAv5VBA	Infosys Wingspan (Infosys Springboard)	15 h	1
2	BMC0086	Java Programming Fundamentals	Infosys Wingspan (Infosys Springboard)	36h 10m	3
3	BMC0088	Lean Six Sigma Green Belt - 2022	Infosys Wingspan (Infosys Springboard)	11h 7 m	0.5

PLEASE NOTE: -

- **A 3-4 weeks Internship shall be conducted during summer break after semester-II and will be assessed during semester-III**
- **Compulsory Audit (CA) Courses (Non-Credit - BNC0301/BNC0302)**
  - All Compulsory Audit Courses (a qualifying exam) do not require any credit.
  - The total and obtained marks are not added in the grand total.

Abbreviation Used:

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., CE: Core Elective, OE: Open Elective, DE: Departmental Elective, PE: Practical End Semester Exam, CA: Compulsory Audit, MOOCs: Massive Open Online Courses.

List of Departmental Electives

Sl. No.	Subject Codes	Subject Name	Types of Subjects	Bucket Name	Branch	Semester
1	BME0511	Factory Automation	Departmental Electives -I	Industry 4.0	ME	5
2	BME0513	Industrial Robots	Departmental Electives –II		ME	5
3	BME0512	Automotive Engineering	Departmental Electives -I	Automotive Engineering	ME	5
4	BME0514	Automotive Engines	Departmental Electives -II		ME	5

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
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Bachelor of Technology
Mechanical Engineering

Evaluation Scheme
SEMESTER-VI

Sl. No.	Subject Codes	Subject	Types of Subjects	Periods			Evaluation Schemes				End Semester		Total	Credit
				L	T	P	CT	TA	TOTAL	PS	TE	PE		
1	BME0601	Refrigeration & Air Conditioning	Mandatory	3	1	0	30	20	50		100		150	4
2		Departmental Elective- III	Department Elective	3	0	0	30	20	50		100		150	3
3		Departmental Elective- IV	Department Elective	3	0	0	30	20	50		100		150	3
4		Open Elective - I	Open Elective	3	0	0	30	20	50		100		150	3
5	BME0662	Departmental Course Workshop - I (Product Lifecycle Management)	Mandatory	0	0	6				50		100	150	3
6	BME0653	Departmental Course Workshop - II (Industrial Automation & IOT)	Mandatory	0	0	6				50		100	150	3
7	BME0651	Refrigeration & Air Conditioning Lab	Mandatory	0	0	2				25		25	50	1
8	BME0659	Mini Project	Mandatory	0	0	6				50		100	150	3
9	BNC0602/ BNC0601	Constitution of India / Essence of Indian Traditional Knowledge	Compulsory Audit	2	0	0	30	20	50		50		100	NA
10		*Massive Open Online Courses (For B.Tech. Hons. Degree)												
		Total		**13**	**1**	**20**	**120**	**80**	**200**	**175**	**400**	**325**	**1100**	**23**

*** List of MOOCs Based Recommended Courses for Second year (Semester-VI) B. Tech Students**

S. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	BMC0050	CATIA V5 - Computer Aided Design (CAD)	Infosys Wingspan (Infosys Springboard)	42h 30m	3.5
2	BMC0012	Data Structures and Algorithms using Python - Part 1	Infosys Wingspan (Infosys Springboard)	29h 27m	2
3	BMC0099	Sustainable Supply Chains	Infosys Wingspan (Infosys Springboard)	6h	0.5

PLEASE NOTE: -

- **A 3-4 weeks Internship shall be conducted during summer break after semester-IV and will be assessed during Semester-V**
- **Compulsory Audit (CA) Courses (Non-Credit - BNC0401/BNC0402)**
  - All Compulsory Audit Courses (a qualifying exam) do not require any credit.
  - The Total and obtained marks are not added in the Grand Total.

Abbreviation Used:

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., CE: Core Elective, OE: Open Elective, DE: Departmental Elective, PE: Practical End Semester Exam, CA: Compulsory Audit, MOOCs: Massive Open Online Courses.

List of Departmental Electives

Sl. No.	Subject Codes	Subject Name	Types of Subjects	Bucket Name	Branch	Semester
1	BME0611	Smart Manufacturing	Departmental Electives-III	Industry 4.0	ME	6
2	BME0613	Machine Learning in Manufacturing	Departmental Electives-IV		ME	6
3	BME0612	Automotive Transmission & Suspension Systems	Departmental Electives-III	Automotive Engineering	ME	6
4	BME0614	Automotive Manufacturing & Materials	Departmental Electives-IV		ME	6

NOIDA INSTITUTE OF ENGINEERING & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
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A student will be eligible to get Under Graduate degree with Honours only, if he/she completes the additional MOOCs courses such as Coursera certifications, or any other online courses recommended by the Institute (Equivalent to 20 credits). During Complete B.Tech. Program Guidelines for credit calculations are as follows.

1. For 6 to 12 Hours =0.5 Credit
2. For 13 to18 =1 Credit
3. For 19 to 24 =1.5 Credit
4. For 25 to 30 =2 Credit
5. For 31 to 35 =2.5 Credit
6. For 36 to 41 =3 Credit
7. For 42 to 47 =3.5 Credit
8. For 48 and above =4 Credit

For registration to MOOCs Courses, the students shall follow Coursera registration details as per the assigned login and password by the Institute these courses may be cleared during the B. Tech degree program (as per the list provided). After successful completion of these MOOCs courses, the students shall provide their successful completion status/certificates to the Controller of Examination (COE) of the Institute through their coordinators/Mentors only.

The students shall be awarded Honours Degree as per following criterion.

i. If he / she secures 7.50 as above CGPA.

ii. Passed each subject of that degree program in the single attempt without any grace.

iii. Successful completion of MOOCs based 20 credits

B. TECH THIRD YEAR	
Subject Code: BCSE0503	**L T P: 2 1 0**
Subject Name: Design Thinking-II	**Credits: 3**

Pre- requisites: Student must complete Design Thinking-I course.

Course Contents/Syllabus

Unit-1	Design thinking & Innovation, Design Thinking Mindset and Principles, recap of 5-Step Process of Design Thinking, Design Approaches, additional in-depth examples of each design approaches. Simon Sinek's – Start with Why, The Golden Circle , Asking the "Why" behind each example (an in-class activity of asking 5-WHYS) , The Higher Purpose, in-class activity for LDO & sharing insights Visualization and it's importance in design thinking , reflections on wheel of life (in-class activity for visualization & Wheel of Life), Linking it with Balancing Priorities (in class activity), DBS Singapore and Bank of Americas' Keep the Change Campaign. Litter of Light & Arvind Eye Care Examples, understanding practical application of design thinking tools and concepts, case study on McDonald's Milkshake / Amazon India's Rural Ecommerce & Gillette Working on 1-hour Design problem, Applying RCA and Brainstorm on innovative solutions. Main project allocation and expectations from the project.	**8 hours**
Unit-2	Refine and narrow down to the best idea, 10-100-1000gm, QBL, Design Tools for Convergence – SWOT Analysis for 1000gm discussion. In-class activity for 10-100-1000gm & QBL Prototyping (Convergence): Prototyping mindset, tools for prototyping – Sketching, paper models, pseudo-codes, physical mockups, Interaction flows, storyboards, acting/role-playing etc, importance of garnering user feedback for revisiting Brainstormed ideas. Napkin Pitch, Usability, Minimum Viable Prototype, Connecting Prototype with 3 Laws, A/B Testing, Learning Launch. Decision Making Tools and Approaches – Vroom Yetton Matrix, Shift-Left, Up, Right, Value Proposition, Case study: Careerbuddy, You-Me-Health Story & IBM Learning Launch. In-class activities on prototyping- paper-pen / physical prototype/ digital prototype of project's 1000gm idea	**8 hours**
Unit-3	Storytelling: Elements of storytelling, Mapping personas with storytelling, Art of influencing, Elevator Pitch, Successful Campaigns of well-known examples, in-class activity on storytelling. Testing of design with people, conducting usability test, testing as hypothesis, testing as empathy, observation and shadowing methods, Guerrilla Interviews, validation workshops, user feedback, record results, enhance, retest, and refine design, Software validation tools, design parameters, alpha &beta testing, Taguchi, defect classification, random sampling. Final Project Presentation and assessing the impact of using design thinking	**8 hours**
Unit-4	Innovation: Need & Importance, Principles of innovations, Asking the Right Questions for innovation, Rationale for innovation, Quality: Principles & Philosophies, Customer perception on quality, Kaizen, 6 Sigma. FinTech case study of Design Thinking application – CANVAS Leadership, types, qualities and traits of leaders and leadership styles, Leaders vs Manager, Personas of Leaders & Managers, Connecting Leaders-Managers with 13 Musical Notes, Trait theory, LSM (Leadership Situational Model), Team Building Models: Tuckman's and Belbin's. Importance of Spatial elements for innovation.	**8 hours**
Unit-5	Comprehensive human goal: the five dimensions of human endeavour (Manaviya - Vyavstha) are: Education-Right living (Sikhsa- Sanskar), Health – Self-regulation (Swasthya - Sanyam), Justice – Preservation (Nyaya-Suraksha), Production – Work (Utpadan – Karya), Exchange – Storage (Vinimya – Kosh), Darshan-Gyan-Charitra (Shifting the Thinking). Interconnectedness and mutual fulfilment among the four orders of nature recyclability and self-regulation in nature, Thinking expansion for harmony: Self-exploration (Johari's window), group behaviour, interpersonal behaviour and skills, Myers-Briggs personality types (MBTI), FIRO-B test to repair relationships.	**8 hours**

Course Outcomes –

CO1	Learn sophisticated design tools to sharpen their problem-solving skills	K2
CO2	Construct innovate ideas using design thinking tools and converge to feasible idea for breakthrough solution	K6
CO3	Implement storytelling for persuasive articulation	K3
CO4	Understanding the nature of leadership empowerment	K2
CO5	Understand the role of a human being in ensuring harmony in society and nature.	K2

Text Books:

Arun Jain, UnMukt : Science & Art of Design Thinking, 2020, Polaris

Gavin Ambrose and Paul Harris, Basics Design 08: Design Thinking, 2010, AVA Publishing SA.

R R Gaur, R Sangal, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, First Edition, 2009, Excel Books: New Delhi

Reference Books:

Jeanne Liedta, Andrew King and Kevin Benett , Solving Problems with Design Thinking – Ten Stories of What Works, 2013, Columbia Business School Publishing.

Dr Ritu Soryan, Universal Human Values and Professional Ethics, 2022, Katson Books.

Vijay Kumar, 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization, 2013, John Wiley and Sons Inc, New Jersey.

Roger L. Martin, Design of Business: Why Design Thinking is the Next Competitive Advantage, 2009, Harvard Business Press, Boston MA.

Tim Brown, Change by Design, 2009, Harper Collins.

Pavan Soni, Design your Thinking : The Mindsets, Toolsets and Skill Sets for Creative Problem-Solving, 2020, Penguin Books.

Links: NPTEL/You Tube/Web Link

1. https://www.youtube.com/watch?v=MJeRFzs4oRU&list=PLBEA57F7E7560C8E8
2. https://www.youtube.com/watch?v=dT-0HzgmudU
3. https://www.youtube.com/watch?v=oQrcPiQuCHI
4. https://www.youtube.com/watch?v=BjkxYZ93Fbs
5. https://www.youtube.com/watch?v=fEdz91oWrts
6. https://www.youtube.com/watch?v=oZhR1HPdvR4
7. https://www.youtube.com/watch?v=CI9xMNvTLFI
8. https://www.youtube.com/watch?v=OlZXxPVpmBs
9. https://www.youtube.com/watch?v=FydJu1A1oeM
10. https://www.youtube.com/watch?v=ty3O5CNaMy8

B.TECH THIRD YEAR

Subject Code: BME0501	**L T P: 3 1 0**
Subject Name: Theory of Machines	**Credits: 4**

Pre- requisites: Basic knowledge of Engineering Mechanics, Basic knowledge of Engineering Mathematics, Basic knowledge of Engineering Drawing

Course Contents/Syllabus

Unit-1	**Mechanism:** Introduction, mechanisms and machines, kinematics and kinetics, kinematic link and its types, kinematic pairs and their classification, kinematic chain, constraint motion, degrees of freedom of planar mechanism, Grobler's equation, inversion of four bar chain, single slider crank chain and double slider crank chain. **Velocity Analysis:** Introduction, velocity of point in mechanism, relative velocity and instantaneous centre method, Kennedy's theorem, velocities in four bar and slider crank mechanism. **Acceleration Analysis:** Introduction, acceleration of a point on a link, Coriolis's component of acceleration, acceleration in four bar and slider crank mechanism, crank and slotted lever mechanism.	**8 hours**
Unit-2	**Cam and Follower:** Introduction, classification of cams and followers, terminology of cam, cam profiles for knife edge, roller and flat faced followers for uniform velocity, simple harmonic motion, uniform acceleration, and retardation. **Gears and Gear Trains:** Introduction, classification of gears, terminology of gear, law of gearing, tooth forms and their comparisons, systems of gear teeth, length of path of contact and arc of contact, contact ratio, minimum number of teeth on gear and pinion to avoid interference, simple, compound, reverted and epicyclic gear trains.	**8 hours**
Unit-3	**Force Analysis:** Static force analysis of mechanisms, D'Alembert's principle, dynamic force analysis of planar mechanisms, engine force analysis, piston effort, crank effort and turning moment on crankshaft. **Flywheel:** Flywheels and its function, turning moment diagrams for single cylinder double acting steam engine, four stroke IC engine and multi-cylinder engines, fluctuation of energy and speed, energy stored by flywheel.	**8 hours**
Unit-4	**Balancing:** Introduction, static balancing, and dynamic balancing, balancing of rotating masses in same plane and different plane, graphical and analytical methods, balancing of reciprocating masses. **Governor:** Introduction, governor and its function, types of governors, centrifugal governors and inertia governors, dead weight and spring controlled centrifugal governors, sensitivity and stability of governor, isochronous governor, hunting of centrifugal governors, effort, and power of governor	**8 hours**
Unit-5	**Gyroscope:** Gyroscopic couples, Gyroscopic stabilization of shaft bearing, aero plane and ships, stability of four wheel and two-wheel vehicles moving on curved paths. **Dynamometers:** Dynamometers, types of dynamometers, prony brake and rope brake dynamometer, belt transmission, epicyclic and torsion dynamometer.	**8 hours**

Course Outcomes –

CO1	Design linkage or mechanism with their inversions for industrial equipment that meets desired specifications and requirements and Perform mechanism analysis to find the position, velocity, acceleration, and dynamics of multi-bar mechanisms.	K3
CO2	Calculate the amount of power transmission through the gear drive and calculate their driving efficiencies.	K3
CO3	Understand balancing of reciprocating and rotary masses through solving engineering problems.	K3
CO4	Analyze the static and dynamic force analysis of various mechanism and design of flywheel.	K4
CO5	Understand the gyroscopic forces and couple and its effect on the stability of aero-plane and ship.	K3

Text Books:

Theory of Machines by S.S. Rattan, McGraw Hill.

Theory of Machines by R. K. Bansal, Laxmi Publications.

Theory of Machines by Khurmi & Gupta, S. Chand Publication.

Kinematics of Machines by Dr. Sadhu Singh, S.K. Kataria & Sons. by V. P. Singh, Dhanpat Rai Publishing Co. Pvt. Ltd.

Reference Books:

Mechanics of Machines by V. Ramamurti, Alpha Science

Theory of Machines and Mechanisms by Rao & Dukkipati, bohem press

Theory of Mechanisms and Machines by Amitabha Ghosh and Ashok Kumar Mallik, Third Edition Affiliated East-West Press.

Theory of Machines and Mechanisms by Joseph Edward Shigley and John Joseph Uicker, Jr. Oxford University Press

Links: NPTEL/You Tube/Web Link

https://www.youtube.com/watch?v=MJeRFzs4oRU&list=PLBEA57F7E7560C8E8
https://www.youtube.com/watch?v=dT-0HzgmudU

https://www.youtube.com/watch?v=oQrcPiQuCHI
https://www.youtube.com/watch?v=BjkxYZ93Fbs

https://www.youtube.com/watch?v=fEdz91oWrts
https://www.youtube.com/watch?v=oZhR1HPdvR4

https://www.youtube.com/watch?v=CI9xMNvTLFI
https://www.youtube.com/watch?v=OlZXxPVpmBs

https://www.youtube.com/watch?v=FydJu1A1oeM
https://www.youtube.com/watch?v=ty3O5CNaMy8

B.TECH THIRD YEAR

Course Code	BME0552	L	T	P	Credit
Course Title	Augmented, Virtual & Mixed Reality	0	0	6	3

Course objective: This course covers the technical and experiential design foundation required for the implementation of immersive environments in current and future virtual, augmented and mixed reality platforms. During the duration of the course students are expected to work in collaborative group projects and develop working prototypes, demo experiences, immersive platforms, unique controllers and new innovative technologies that can be used in the development and production of immersive environments in the fields of entertainment, education, training, medical and industrial innovation.

Pre-requisites: Students should have basic knowledge of product design & development and manufacturing.

Course Contents / Syllabus

Suggested list of Experiment

Sr. No.	Name of Experiment
1	Introduction & Understanding to Augmented Reality Concepts
2	Installation of Unity and Visual Studio, setting up Unity for VR development, understanding documentation of the same.
3	Demonstration of the working of HTC Vive, Google Cardboard, Google Daydream and Samsung gear VR.
4	Develop a scene in Unity that includes, a cube, plane and sphere, apply transformations on the 3 game objects, add a video and audio source.
5	Develop a scene in Unity that includes a cube, plane and sphere. Create a new material and texture separately for three Game objects. Change the colour, material and texture of each Game object separately in the scene.
6	Develop a scene in Unity that includes a sphere and plane. Apply Rigid body component, material and Box collider to the game Objects. Study to grab and throw the sphere using vr controller.
7	Develop a simple U I(User interface) menu with images, canvas, sprites and button. Interact with UI menu through VR trigger button such that on each successful trigger interaction display a score on scene
8	Create an immersive environment (living room/ battlefield/ tennis court) with only static game objects. 3D game objects can be created using Blender or use available 3D models.
9	Include animation and interaction in the immersive environment created.
10	Develop a VR environment for flying helicopter/moving car simulation.
11	Develop a VR game in Unity such that on each gun trigger click, destroy the cubes placed on the plane and gain a score point. Make a score UI and display it on the screen .
12	Welcome to Vuforia Studio
13	Supported Devices, Operating System, and Browser
14	Install Vuforia Studio
15	Core Components and Concepts
16	Understanding Thing Mark
17	Create and publish the mobile Experience-Introduction
18	Add 2D widgets to a Mobile Experience
19	Bind a 2D Widget to a 3D Model
20	Use a Sequence List in an Experience
21	Projects development e.g.: Creating Simple AR Experiences, Coffee Maker Add Project, Robot Service Projects, Blue pump Project.

Course outcome: After completion of the course, the student will be able to

CO 1	To introduce Augmented, Virtual & Mixed Reality, the tool of Industry 5.0.	K3
CO 2	To develop content & use various types of Hardware and Software in Virtual Reality systems.	K3
CO 3	To develop content & use various types of Hardware and Software in Augmented Reality systems.	K3
CO4	To apply VR, AR, MR, and XR in the real-world scenarios during the project lifecycle.	K3
CO 5	To understand the applications of AR, VR, MR & XR	K3

B.TECH THIRD YEAR

Subject Code: BME0553	**L T P: 0 0 6**
Subject Name: Automotive Mechatronics	**Credits: 3**

Pre- requisites: Foundational knowledge in mechanical engineering and materials science.

Course Contents/Syllabus

Unit-1	**Introduction to Automotive Mechatronics-** Definition, scope, and importance of mechatronics in automobiles Key components: sensors, actuators, ECUs Overview of automotive systems (engine, chassis, transmission, braking, and infotainment) Trends in automotive mechatronics (e.g., ADAS, electrification, autonomy)	**4 hours**
Unit-2	**Automotive Sensors and Actuators-**Common sensors in vehicles: temperature, position, speed, pressure, oxygen sensors, etc. Working principles and characteristics Actuators: solenoids, motors, hydraulic and pneumatic types Signal conditioning and data acquisition basics	**4 hours**
Unit-3	**Electronic Control Units (ECU) and Communication Protocols-** Architecture and functions of ECUs in vehicles Memory organization, Input/Output handling Overview of in-vehicle networks: CAN, LIN, FlexRay, and MOST Diagnostics and OBD-II basics	**4 hours**
Unit-4	**Control Systems and Applications in Vehicles-** Basics of control theory in automotive context Open-loop vs closed-loop systems Cruise control, ABS, TCS, and electronic stability control Drive-by-wire systems	**4 hours**
Unit-5	**Mechatronics in Electric and Hybrid Vehicles-**Powertrain components overview Integration of motor control with ECUs Battery Management Systems (BMS) Regenerative braking and energy recovery systems Introduction to vehicle diagnostics and fault detection	**4 hours**

Text Books:

- Introduction to Manufacturing Processes, M. Mikell P. Groover
- Manufacturing Processes for Engineering Materials", Serope Kalpakjian & Steven R. Schmid
- Materials Science and Engineering: An Introduction", William D. Callister
- Principles of Materials Science and Engineering", William F. Smith

Reference Books:

- Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Wiley. (2015), Groover, M.P.
- Manufacturing Engineering and Technology, Pearson. (2014), Kalpakjian, S., & Schmid, S. R
- Manufacturing Processes for Engineering Materials, Pearson. (2019), Serope Kalpakjian, Steven R. Schmid
- Fundamentals of Engineering Materials, McGraw-Hill. (2014), Jain, R.K.
- Engineering Materials 1: An Introduction to Properties, Applications, and Design, Butterworth-Heinemann. (2012), Ashby, M.F., & Jones, D.R.H.

Links: NPTEL/You Tube/Web Link

- https://archive.nptel.ac.in/courses/107/106/107106088/
- https://archive.nptel.ac.in/courses/112/107/112107219/
- https://archive.nptel.ac.in/courses/112/103/112103293/
- https://www.youtube.com/watch?v=2rxbxNem1iI&list=PLyqSpQzTE6M_ON8uXt-PP8uX6hMWJeYSJ
- https://www.youtube.com/watch?v=KMcsjCXfLQw&list=PLyAZSyX8Qy5Am_2StOOQ5vCUE3VIcAenE

Suggested list of Experiment

Sr. No.	Name of Experiment
1	Study and identification of mechatronic systems in a modern vehicle (engine, transmission, braking, etc.).
2	Demonstration of ECUs and basic vehicle communication layout using a cut-section of a car.
3	Case study presentation on an advanced mechatronic system, e.g., ADAS or electric power steering.
4	Measurement of temperature, speed, and position using commonly used vehicle sensors (thermistors, hall-effect, potentiometers).
5	Simulation and testing of sensor outputs using DAQ systems and oscilloscope or LabVIEW.
6	Demonstration and control of actuators (solenoids, DC motors, pneumatic actuators) via microcontrollers.
7	Hands-on with a basic ECU trainer kit: Reading inputs and outputs (I/O) and controlling vehicle subsystems.
8	Simulate CAN bus communication between two ECUs using CANoe or MATLAB/Simulink.
9	Read fault codes using OBD-II scanner from a test vehicle and interpret DTCs (Diagnostic Trouble Codes).
10	Simulation of cruise control system using MATLAB/Simulink.
11	Design and test of a closed-loop braking system model to study ABS principles.
12	PID controller tuning for an automotive load system using Arduino or MATLAB.
13	Analysis of motor drive integration with ECU for a small-scale electric vehicle platform.
14	Battery Management System (BMS) simulation and cell balancing logic testing using MATLAB or Simulink.
15	Demonstration of regenerative braking using motor-generator test bench.

Course outcome: After completion of the course, the student will be able to

CO 1	Describe the fundamental principles and scope of automotive mechatronics, identifying key components and current trends in the automotive industry.	K2
CO 2	Explain the working principles and selection criteria of various sensors and actuators used in automotive applications.	K2
CO 3	Illustrate the architecture of automotive ECUs and apply knowledge of in-vehicle communication protocols such as CAN and LIN for diagnostic purposes.	K2
CO4	Apply control system concepts to automotive applications such as cruise control, ABS, and drive-by-wire systems.	K3
CO 5	Demonstrate an understanding of mechatronic subsystems in electric and hybrid vehicles including battery management and regenerative braking.	K2

B.TECH THIRD YEAR

Course Code	BME0551	L	T	P	Credit
Course Title	Theory of Machines Lab	0	0	4	2

Pre-requisites: Engineering Mechanics, Strength of Materials, Engineering Drawing

Course Contents / Syllabus

Suggested list of Experiment

Sr. No.	Name of Experiment
1	Study of simple linkage models/mechanisms
2	Study of inversions of four bar linkage
3	Study of inversions of single/double slider crank mechanisms
4	Experiment on cam and follower motion
5	Experiment on static/dynamic balancing
6	Experiment on gear trains
7	Experiment on watt governor
8	Experiment on porter governor
9	Experiment on proell governor
10	Experiment on hartnell governor
11	Experiment on gyroscope
12	Experiment on critical speed of shaft
13	Experiment on longitudinal vibration
14	Experiment on transverse vibration

Course outcome: After completion of the course, the student will be able to

CO 1	Understand the relative motion between the element of a mechanisms and their inversion for the specified type of motion in a machine.	K2
CO 2	Understand various motion of follower and the fundamental principles of balancing to balance the masses statically & dynamically of a rotating mass system and observe the effect of unbalance in a rotating mass system.	K2
CO 3	Demonstrate the torque analysis and measure epicyclic gear ratio on any kind of on engine or machine shaft.	K2
CO4	Understand the working principle of a governor and able to identify different types of governors in actual practice for maintain the constant speed of engine.	K2
CO 5	Understand the fundamental principles of gyroscope & vibrations and observe the effect of gyroscopic couple and vibrations on a rotating disc.	K2

B.TECH THIRD YEAR	
Subject Code: BME0511	**L T P: 3 0 0**
Subject Name: Factory Automation	**Credits: 3**

Pre- requisites: NIL

Course Contents/Syllabus

Unit-1	**Introduction to Factory Automation-** Introduction to Automation in Production Systems, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automation, Flow Lines and Transfer Mechanisms, Fundamentals of Transfer Lines.	**8 hours**
Unit-2	**Material Handling and Identification Technologies-** Overview of Material Handling Systems, Applications of Material Handling Systems, Material Transport Systems, Storage Systems, Overview of Automatic Identification Methods.	**8 hours**
Unit-3	**Automated Manufacturing Systems-** Components, Classification and Overview of Manufacturing Systems, Manufacturing Cells, GT and Cellular Manufacturing, FMS, FMS and its Planning and Implementation. Quality Control Systems: Traditional and Modern Quality Control Methods, SPC Tools, Inspection Principles and Practices, Inspection Technologies.	**8 hours**
Unit-4	**Control Technologies in Automation: -** Industrial Control Systems, Process Industries versus Discrete Manufacturing Industries, Continuous Versus Discrete Control, Computer Process and its Forms.	**8 hours**
Unit-5	**Computer Based Industrial Control: -** Introduction & Automatic Process Control, Building Blocks of Automation Systems: LAN, Analog & Digital I/O Modules, SCADA Systems & RTU. Distributed Control System: Functional Requirements, Configurations.	**8 hours**

Course Outcomes – After completion of the course, the student will be able to

CO1	Explain the principles and strategies of automation in production systems, including basic elements, advanced functions, and levels of automation.	K2
CO2	Design and apply material handling systems.	K4
CO3	Analyze and implement automated manufacturing systems.	K3
CO4	Apply industrial control systems.	K3
CO5	Design and implement computer-based industrial control systems.	K4

Text Books:

Automation, Production Systems, and Computer-Integrated Manufacturing, Mikell P. Groover

Manufacturing Automation: Metal Cutting Mechanics, Machine Tool Vibrations, and CNC Design, Yusuf Altintas

Industrial Automation: Handbook of the Practical Man, Frank Lamb

Automated Manufacturing Systems with PLCs, Hugh Jack

Reference Books:

Computer Control of Machines and Processes, John G. Bollinger and Neil A. Duffie

Industrial Control Electronics: Applications and Design, J. Michael Jacob

Automation and Control Systems, Frank Petruzella

Links: NPTEL/You Tube/Web Link

1. https://www.youtube.com/@realpars
2. https://www.youtube.com/@Automationanywhere
3. https://www.youtube.com/@Automationanywhere

B.TECH THIRD YEAR	
Subject Code: BME0513	**L T P: 3 0 0**
Subject Name: Industrial Robotics	**Credits: 3**

Pre- requisites: NIL

Course Contents/Syllabus

Unit-1	**Introduction to Industrial Robotics,** Introduction to Industrial Robots, Evolution of robots, International Robotic Standards, Types of robots, Selection of robots, Robot Classifications, Configuration &Specification of industrial Robots, Robot feedback controls: Point to point control and Continuous path control, Control system for robot joint, Adaptive control, Types of end effectors with application, Operation and programming, Economics of robotics, Workcell design principles and system integration, Robot installation, peripheral devices of robot.	**8 hours**
Unit-2	**Kinematics of Robots-Direct Kinematics** link, Robot coordinates system, D-H Representation, Geometric transformation, Direct kinematic analysis for articulated manipulator, SCARA Robot. **Inverse Kinematics** Need of inverse kinematics, inverse kinematics for articulated manipulator, Multiple solutions and singularities, Robot reachability and dexterity measures, Tool configuration and positioning	**8 hours**
Unit-3	**Dynamics of Robots- Dynamics** Introduction to Robot dynamics, Static forces and torques in robot manipulators, Gravity compensation and payload considerations, Lagrange's equation kinetic and potential energy.	**8 hours**
Unit-4	**Trajectory Planning & Machine Vision-** Fundamentals of trajectory planning, Joint space vs. Cartesian space planning, Point-to-point motion vs. continuous path motion, Interpolation methods (linear, circular, spline), Path constraints and optimization, Motion profiles (trapezoidal, S-curve, polynomial), Collision detection and avoidance strategies, Multi-point path planning. Machine vision Machine vision fundamentals for robotics, Camera types and selection, Camera calibration concepts, Image processing basics for robotics, Object detection and recognition, Pose estimation techniques, Vision-guided robot applications, Pick and place from vision, Visual servoing concepts, Quality inspection systems, Bin picking applications, Sensor fusion and multi-sensor integration.	**8 hours**
Unit-5	**Programming & Robot Operating System-** Introduction to robot programming methods, Teach pendant programming, Lead-through programming, Textual programming languages, Robot program structure and syntax, Programming motion commands, I/O handling in robot programs, Program flow control and logical operations, Subroutines and modularity in robot programming, **ROS** architecture and philosophy, ROS concepts: nodes, topics, services, and actions, Publisher-subscriber communication pattern, Workspace setup and package management, Robot modeling in ROS, Coordinate frames and transformations using TF, ROS-Industrial framework, Integration with commercial robots, Developing applications with ROS, Basic programming patterns, Navigation and manipulation, Sensor integration in ROS, Creating custom ROS packages, Deployment of ROS applications to physical robots.	**8 hours**

Course Outcomes –

CO1	Identify and describe various industrial robot types and their applications.	K3
CO2	Understand robot kinematics concepts and apply them to real-world scenarios.	K5
CO3	Apply basic dynamics and control principles to robotic systems.	K5
CO4	Develop trajectory planning strategies and implement vision-based applications.	K6
CO5	Utilize robot simulation tools and implement applications using ROS.	K6

Text Books:

"Industrial Robotics Technology programming and Applications", McGraw-Hill, M.P. Groover, M. Weiss, R.N. Nagel, and N.G. Odrey

Robotics: Fundamental Concepts and Analysis by, Oxford University Press, Ashitava Ghosal
"Robotics and Control", TMH Publications, R.K. Mittal and I.J. Nagrath,
"Fundamentals of Robotics Analysis and Control", PHI Learning, Robert J. Schilling,
Learning ROS for Robotics Programming, Packt Publishing, 2nd Edition (2015), ISBN: 9781783987443., Aaron Martinez and Enrique Fernández,
Reference Books:
Robotic Engineering: An Integrated Approach, Pearson Education, 1st Edition (2003), ISBN: 9788120325124., Richard D. Klafter, Thomas A. Chmielewski, and Michael Negin
Modern Robotics: Mechanics, Planning, and Control, Cambridge University Press, 1st Edition (2017), ISBN: 9781107156302., Kevin M. Lynch and Frank C. Park
Probabilistic Robotics, and Dieter Fox, MIT Press, 1st Edition (2005), ISBN: 9780262201629., Sebastian Thrun, Wolfram Burgard
Links: NPTEL/You Tube/Web Link
Industrial Robotics and Automation - Course Introduction
Robotics by Prof D K Pratihar
Introduction to Robotics
Programming for Robotics (ROS) Course 1

B.TECH THIRD YEAR		
Subject Code: BME0512		**L T P: 3 0 0**
Subject Name: Automotive Engineering		**Credits: 3**
Pre- requisites: NIL		
Course Contents/Syllabus		
Unit-1	**Introduction to Automotive Engineering- Introduction to Automobile Engineering:** Definition, history, and importance of automobiles in modern transportation. **Classification of Automobiles:** Based on purpose, fuel type, drive type, and body style (e.g., passenger cars, commercial vehicles, electric vehicles). **Vehicle Configurations:** Front-engine, rear-engine, mid-engine layouts; drive types – FWD, RWD, AWD/4WD. **Introduction to Vehicle Dimensions and Terminology:** Wheelbase, track width, ground clearance, approach/departure angles, etc. **General Layout of an Automobile:** Overview of main systems powertrain, chassis, suspension, braking, steering, electrical, and body components.	**8 hours**
Unit-2	**I.C. Engines Vehicles- Introduction to I.C. Engines**: Basic principles and working of internal combustion engines; classification – spark ignition (SI) and compression ignition (CI) engines. **Engine Types and Configurations**: 2-stroke vs 4-stroke engines, inline vs V-type engines, air-cooled vs water-cooled engines. **Main Components of I.C. Engines**: Engine block, piston, crankshaft, connecting rod, camshaft, valves, cylinder head, flywheel. **Engine Systems Overview**: Fuel supply system (carburetor, fuel injection, common rail direct injection). Ignition system (battery ignition, magneto, spark plugs). Cooling system (radiator, thermostat, coolant, water pump). Lubrication system (wet sump, dry sump, oil pump, oil filters). **Basic Engine Terminology**: Bore, stroke, compression ratio, displacement, power, torque, efficiency.	**8 hours**
Unit-3	**Electric and Hybrid Vehicles- Introduction to Electric Vehicles (EVs)**: Evolution, need for electrification, advantages and challenges of electric mobility. **Classification of Electric Vehicles**: Battery Electric Vehicles (BEVs), Hybrid Electric Vehicles (HEVs), Plug-in Hybrid Electric Vehicles (PHEVs), and Fuel Cell Vehicles (FCVs). **Basic Components of an Electric Vehicle**: Electric motor, battery pack, power electronics, inverter, converter, and electric drivetrain.**Types of Electric Motors Used**: DC motors, Brushless DC (BLDC), Induction motors, Permanent Magnet Synchronous Motors (PMSM). **Battery Technologies**: Lead-acid, Nickel-Metal Hydride (NiMH), Lithium-ion batteries – structure, working, advantages, limitations.Hybrid Powertrain Architectures: Series, parallel, and series-parallel hybrids working principles and power flow. **Regenerative Braking and Energy Recovery**: Concept and operation in EVs and hybrids. **Comparison with I.C. Engine Vehicles**: Efficiency, emissions, range, maintenance, and overall performance.	**8 hours**
Unit-4	**Transmission and Braking System- Clutch Systems** – Types of clutches: single plate, multi-plate, centrifugal, and diaphragm; basic operation and applications. **Gearboxes** – Manual (sliding mesh, constant mesh, synchromesh) and automatic transmissions (CVT, AMT, DCT); gear shifting mechanisms. Final Drive and Differential – Function and construction; power transmission to wheels in various drivetrain layouts. **Drive Configurations** – Overview of FWD, RWD, AWD, and 4WD systems with their advantages and use cases.	**8 hours**
Unit-5	**Modern Automotive Technologies- Automotive Electronics**: Role of Electronic Control Units (ECUs), Integrated Circuit Modules (ICMs), sensors, and actuators in controlling vehicle performance, safety, and emissions. **On-Board Diagnostics (OBD)**: OBD-II and OBD-III systems, real-time monitoring, diagnostic trouble codes (DTCs), and advanced fault detection systems.	**8 hours**

	Advanced Driver Assistance Systems (ADAS) – Features like Lane Departure Warning (LDW), Forward Collision Warning (FCW), Automatic Emergency Braking (AEB), Pedestrian Detection, Adaptive Cruise Control (ACC), Traffic Sign Recognition (TSR), and 360-degree cameras.	

Course Outcomes – After completion of the course, the student will be able to

CO1	Describe the fundamental principles of automobile engineering, including the general layout of a vehicle and the concepts of power, torque, and various resistances to motion.	K2
CO2	Explain the working principles, components, and performance characteristics of both Spark Ignition and Compression Ignition internal combustion engines, including their cycles, timing diagrams, emissions, and firing order.	K2
CO3	Explain EV, hybrid types, propulsion types, energy, and comparing their environmental and economic impacts against conventional vehicles.	K2
CO4	Explain the operation of different automotive transmission systems and braking systems	K2
CO5	Discuss ADAS, telematics, infotainment, sensors, ECUs, CAN bus, autonomous/connected concepts, advanced materials, IoT, and cybersecurity trends.	K2

Text Books:

Automobile Engineering , Newton and Steeds

Automobile Engineering , Ramakrishna, PHI, India.

Automobile Engineering , Kripal Singh

Reference Books:

Automotive Engineering- Hietner.

Automobile Engineering - Narang

Automobile Engineering – TTTI, Pearson India

Links: NPTEL/You Tube/Web Link

http://digimat.in/nptel/courses/video/107106088/L01.html

https://www.google.com/search?q=https://www.youtube.com/playlist%3Flist%3DPLwdnKv6Jags1bzjeJRhFTfVn1L7JmZJma

https://onlinecourses.nptel.ac.in/noc24_de03/preview

B.TECH THIRD YEAR

Subject Code: BME0514	**L T P: 3 0 0**
Subject Name: Automotive Engines	**Credits: 3**

Pre- requisites: NIL

Course Contents/Syllabus

Unit-1	**Engine Fundamentals,** Engine types and their operation- classifications – Terminology- Four stroke and two stroke cycle Engine components, working principle of SI and CI engines – Engine operating parameters- Fuel – air and actual cycle analysis – Engine emissions – valve and port timing diagram – firing order	**8 hours**
Unit-2	**Induction And Ignition System-**Carburettors – mixture requirements – working principles, different circuits – Requirements and objective of injection system – types of injection – Jerk and distributor type pumps, Unit injector, common rail direct injection – Electronic fuel injection – GDI, Injection timing, Injection lag. Types of injection nozzle. Spray characteristics. Split and Multiple injection. Mechanical and pneumatic governors. Ignition system- battery coil, magneto coil and Electronic ignition system	**8 hours**
Unit-3	**Combustion Of Fuels-** Combustion in SI engine – Stages of combustion- Flame Propagation- Rate of pressure rise Abnormal combustion- combustion chambers – design objectives and types Engine Knock Thermodynamic analysis of SI engine combustion- Burned and Unburned mixture states – combustion process characterization- CI Engine – Importance of air motion – Swirl, Squish and Tumble. Swirl ratio. Stages of combustion. Delay period – factors affecting delay period. knock in CI & SI engines. Direct and indirect injection combustion chambers for diesel combustion.	**8 hours**
Unit-4	**Engine Cooling, Lubricating And Exhaust System-** Cooling system – Function- types – working principle – Lubricating system- Function- types Lubricant Requirements Necessity and limitation of supercharging. Types of super charger and turbo charger. Intercooler. Matching of turbocharger. Modification of an engine for supercharging. Effect of supercharging on engine performance- exhaust system- exhaust manifold – muffler types.	**8 hours**
Unit-5	**Engine Testing And Measurements-** Engine testing and measuring equipment- Indicated and brake MEP, operating variables that affect engine performance, efficiency and emission – Automotive and stationary engine testing and related standards – use of transient dynamometer for engine testing. Engine power– measurement of indicated power-brake power- frictional power- efficiencies – Heat balance – Methods to improve engine performance.	**8 hours**

Course Outcomes – After completion of the course, the student will be able to

CO1	Understand engine types, components, and operating principles of SI and CI engines, including cycle analysis and emissions.	K2
CO2	Analyze fuel delivery and ignition systems, including carburetors, injectors, nozzles, and ignition mechanisms.	K3
CO3	Evaluate combustion processes in SI and CI engines and identify factors affecting knocking and combustion chamber design.	K2
CO4	Explain engine cooling, lubrication, supercharging, turbocharging, and exhaust systems and their impact on performance.	K2
CO5	Conduct engine testing, measure performance parameters, and interpret results using standard testing methods.	K2

Text Books:

Internal Combustion Engines, John B.Heywood,

Internal Combustion Engine, M.L. Mathur and R.P.Sharma

Internal Combustion Engines, V. Ganesan

Reference Books:

Advanced engine technology, Heinz Heisler

High Speed Combustion Engines, Heldt, P.M.

Internal Combustion Engines, K. K. Ramalingm
Internal Combustion Engine analysis and Practice, Obert, E.F.

Links: NPTEL/You Tube/Web Link

#1 course overview & classification of internal combustion engines | part 01
lec 1: introduction to engine systems and its types: a focus on ignition system
lec 16: fuels and combustion (part i)
noc19-ae02 lec 13 - cooling and exhaust system (lab session)
ic engine- performance and testing of ic engine numericals

B.TECH THIRD YEAR

Subject Code: BNC0501	**L T P: 2 0 0**
Subject Name: Constitution of India	**Credits: 2**

Pre- requisites: Computer Organization and Architecture

Course Contents/Syllabus

Unit-1	INTRODUCTION AND BASIC INFORMATION ABOUT INDIAN CONSTITUTION : Meaning of the constitution law and constitutionalism, Historical Background of the Constituent Assembly, Government of India Act of 1935 and Indian Independence Act of 1947,Enforcement of the Constitution, Indian Constitution and its Salient Features, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System, Centre-State Relations, Amendment of the Constitutional Powers and Procedure, The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency, and Local Self Government – Constitutional Scheme in India.	**8 hours**
Unit-2	UNION EXECUTIVE AND STATE EXECUTIVE: Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Comparison of powers of Indian President with the United States, Powers and Functions of VicePresident, Powers and Functions of the Prime Minister, Judiciary – The Independence of the Supreme Court, Appointment of Judges, Judicial Review, Public Interest Litigation, Judicial Activism, LokPal, Lok Ayukta, The Lokpal and Lok ayuktas Act 2013, State Executives – Powers and Functions of the Governor, Powers and Functions of the Chief Minister, Functions of State Cabinet, Functions of State Legislature, Functions of High Court and Subordinate Courts	**8 hours**
Unit-3	INTRODUCTION AND BASIC INFORMATION ABOUT LEGAL SYSTEM: The Legal System: Sources of Law and the Court Structure: Enacted law -Acts of Parliament are of primary legislation, Common Law or Case law, Principles taken from decisions of judges constitute binding legal rules. The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court). Arbitration: As an alternative to resolving disputes in the normal courts, parties who are in dispute can agree that this will instead be referred to arbitration. Contract law, Tort, Law at workplace.	**8 hours**
Unit-4	INTELLECTUAL PROPERTY LAWS AND REGULATION TO INFORMATION: Intellectual Property Laws: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright and its Ownership, Infringement of Copyright, Civil Remedies for Infringement, Regulation to Information, Introduction, Right to Information Act, 2005, Information Technology Act, 2000, Electronic Governance, Secure Electronic Records and Digital Signatures, Digital Signature Certificates, Cyber Regulations Appellate Tribunal, Offences, Limitations of the Information Technology Act.	**8 hours**
Unit-5	BUSINESS ORGANIZATIONS AND E-GOVERNANCE: Sole Traders, Partnerships: Companies: The Company's Act: Introduction, Formation of a Company, Memorandum of Association, Articles of Association, Prospectus, Shares, Directors, General Meetings and Proceedings, Auditor, Winding up. E-Governance and role of engineers in E-Governance, Need for reformed engineering serving at the Union and State level, Role of I.T. professionals in Judiciary, Problem of Alienation and Secessionism in few states creating hurdles in Industrial development.	**8 hours**

Course Outcomes – After completion of the course, the student will be able to

CO1	Identify and explore the basic features and modalities about Indian constitution.	K1
CO2	Differentiate and relate the functioning of Indian parliamentary system at the center and state level.	K2
CO3	Differentiate different aspects of Indian Legal System and its related bodies	K4
CO4	Discover and apply different laws and regulations related to engineering practices.	K4
CO5	Correlate role of engineers with different organizations and governance models	K4

Text Books:

M Laxmikanth: Indian Polity for civil services and other State Examination,6th Edition, Mc Graw Hil

Brij Kishore Sharma: Introduction to the Indian Constitution, 8th Edition, PHI Learning Pvt. Ltd
Granville Austin: The Indian Constitution: Cornerstone of a Nation (Classic Reissue), Oxford University Press.
Reference Books:
Madhav Khosla: The Indian Constitution, Oxford University Press
PM Bakshi: The Constitution of India, Latest Edition, Universal Law Publishing.
V.K. Ahuja: Law Relating to Intellectual Property Rights (2007)
Links: NPTEL/You Tube/Web Link

B.TECH THIRD YEAR

Subject Code: BME0601	**L T P: 3 1 0**
Subject Name: REFRIGERATION AND AIR CONDITIONING	**Credits: 4**

Pre- requisites: Thermodynamics, Basic Fluid Mechanics, Heat and Mass Transfer

Course Contents/Syllabus

Unit-1	**Basics of refrigeration and Air Conditioning- Introduction**: Brief history and need of refrigeration and air conditioning, methods of natural refrigeration, unit of refrigeration, coefficient of performance, types and application of refrigeration. **Air refrigeration:** Reversed Carnot cycle and its limitation, Bell-Coleman cycle, aircraft refrigeration, working and analysis of Simple; Bootstrap; Reduced ambient and Regenerative air refrigeration systems, comparison of different aircraft refrigeration systems with Mach number.	**8 hours**
Unit-2	**Refrigerants and Vapour compression refrigeration.- Refrigerants**: Classification, nomenclature, desirable properties, secondary refrigerants, future industrial refrigerants, recent trends in refrigerants and its environmental impact. **Vapour Compression system:** Simple system on P-h and T-s diagrams, analysis of the simple cycle, factors affecting the performance of the cycle, actual cycle. Compound Compression System: Compound compression with intercooler, flash gas removal and flash intercooler, Multistage vapour compression system requirement, Different configuration of multistage system, cascade refrigeration system.	**8 hours**
Unit-3	**Absorption and other refrigeration systems- Absorption Refrigeration System:** Working Principal of vapour absorption refrigeration system, Comparison between absorption & compression systems. practical NH3- H2O cycle, LiBr – H2O system and its working, Electrolux refrigeration system. **Other refrigeration systems:** Thermo-electric refrigeration system, Steam jet refrigeration system, Vortex tube refrigeration system, Magnetic refrigeration system.	**8 hours**
Unit-4	**Air conditioning- Psychrometry:** Psychrometric properties and their definitions, Psychrometric chart, Different Psychrometric processes, Thermal analysis of human body, Effective temperature and comfort chart, Cooling and heating load calculations, Selection of inside & outside design conditions, Heat transfer through walls & roofs, Infiltration & ventilation, Internal heat gain, Sensible heat factor (SHF), By pass factor, Grand Sensible heat factor (GSHF), Apparatus dew point (ADP). **Air conditioning systems and components:** Summer and winter air conditioning system, Air ventilation system, Air Washers, Cooling towers.	**8 hours**
Unit-5	**Refrigeration System Equipment**: Compressors, Condensers, Expansion Devices and Evaporators, Elementary knowledge of transmission and distribution of air through ducts and fans. **Application:** Food preservation, Transport refrigeration, Cold storage, Refrigerates Freezers, Ice plant, Water coolers, Comfort and Industrial air conditioning..	**8 hours**

Course Outcomes – After completion of the course, the student will be able to

CO1	Illustrate the basic concepts of refrigeration and air conditioning systems and air refrigeration cycles	K3
CO2	Analyze the simple vapour compression refrigeration systems, multi stage vapour compression refrigeration systems and the properties, applications and environmental issues of different refrigerants used in refrigeration and air conditioning,	K3
CO3	Familiarize about the various equipment employed in refrigeration and air conditioning systems and grasp construction and working of vapour absorption system.	K3
CO4	Calculate the heating and cooling load requirements of a room and design it for human and industrial comfort.	K3
CO5	Apply scientific and engineering principles to analyze and design of ducting and ventilation systems that relate to refrigeration and air conditioning.	K3

Text Books:

Refrigeration and Air Conditioning , McGraw-Hill India Publishing Ltd., C P Arora

Refrigeration and Air-conditioning , Prentice Hall of India, Ramesh Arora
Refrigeration and Air Conditioning, New Age International Publisher, Manohar Prasad
Principles of Refrigeration , Pearson Education, Roy. J Dossat
Refrigeration and Air Conditioning, Prentice Hall of India Pvt. Ltd., Jordon and Prister
Reference Books:
Refrigeration and Air Conditioning, S.Chand Publication, R.S. Khurmi & J.K.Gupta,
Links: NPTEL/You Tube/Web Link
https://youtu.be/4mWsRUr0A7A
https://youtu.be/XO2PBDMEHfs
https://youtu.be/4w3Obp8ILpA
https://youtu.be/0BOVDcMxlyY
https://youtu.be/ExNJoT_2XeI

B.TECH THIRD YEAR

Course Code	BME0662	L	T	P	Credit
Course Title	Product Lifecycle Management (Workshop Mode)	0	0	6	3

Pre-requisites: Students should have basic knowledge of product design & development and manufacturing.

Course Contents / Syllabus

Suggested list of Experiment

Sr. No.	Name of Experiment
Module 1.1	**Introduction to Product Life Cycle Management (PLM):** Definition, PLM Lifecycle Model, Threads of PLM, Need for PLM, Opportunities and Benefits of PLM.
Module 1.2	Views, Components and Phases of PLM, PLM feasibility Study, PLM Visioning.
1.3	**Introduction to PTC Windchill,** Windchill Environment
1.4	Homepage Interface, Locating Information, Viewing Information,
1.5	Introduction to Visualization, Managing Your Work
1.6	Oracle and Windchill Installation
1.7	Creating and Managing Documents
1.8	Creo Parametric Data Administration, Part & CAD Data Management,
Module 1.9	**PLM Concepts, Processes and Workflow:** Characteristics of PLM, Environment Driving PLM, PLM Elements, Drivers of PLM, Conceptualization.
Module 1.10	Design, Development, Validation, Production, Support of PLM.
1.11	Manage Design Development
1.12	Working With CAD Data
1.13	Manage Family Tables
1.14	Change Management
1.15	Exercises on Change Management
1.16	Introduction to Windchill Business Administration, Quiz-1
Module 2.1	**Collaborative Product Development:** Engineering Vaulting, Product Reuse, Smart Parts, Engineering, Change Management.
Module 2.2	Prototype Development, Design for Environment, Virtual Testing and Validation, Marketing Collateral.
2.3	Managing Objects, Object Types, and Object Attributes
2.4	Managing Domain Policies and Access Control
2.5	Object Initialization Rules OIRs
2.6	Exercises on Object Initialization Rules OIRs
2.7	Lifecycle Template Administration
2.8	Exercises on Lifecycle Template Administration,
Module 2.9	**Digital Manufacturing – PLM:** Digital Manufacturing, Benefits of Digital Manufacturing, Manufacturing the First-One.
Module 2.10	Ramp Up, Virtual Learning Curve, Manufacturing the Rest, Production Planning.
2.11	Policy Administration Preferences
2.12	Exercises on Policy Administration Preferences
2.13	Type and Attribute Management
2.14	Exercises on Type and Attribute Management
2.15	Workflow Administration
2.16	Exercises on Workflow Administration, Quiz-2
Module 3.1	**Developing a PLM Strategy:** Strategy, Impact of strategy, implementing a PLM strategy, PLM Initiatives to Support Corporate Objectives.
Module 3.2	**Conducting a PLM Assessment:** Infrastructure Assessment, Assessment of Current Systems and Applications.
3.3	Windchill API, Data models
3.4	Exercises on Windchill API, Data models
3.5	Listeners

3.6	Exercises on Listeners
3.7	Form Processor, Validator and Filter
3.8	Exercises on Form Processor, Validator and Filter,
Module 3.9	**Supply Chain Management:** Basic Concepts and Introduction – Procurement, Supply Chain Management, Project Procurement and Subcontract Management.
Module 3.10	Vendor Management, Inventory Management.
3.11	Eclipse and debugger configurations
3.12	Exercises on Eclipse and debugger configurations
3.13	Windchill Customization Basics
3.14	The Windchill Development Environment
3.15	User Interface Customization
3.16	MCV Builders, Quiz-3
Module 4.1	**Project Cost Management:** Essentials of Cost Management, Cost Estimation, Cost Budget and Variance Analysis.
Module 4.2	Cost Monitoring and Control, Essentials of Project Cash Flows.
4.3	Managing Windchill Services
4.4	Managing Windchill Properties
4.5	File Vaulting and Replication Overview
4.6	Tuning Windchill Server
4.7	Windchill Backup and Recovery
4.8	Managing Log Files and Alerts,
Module 4.9	Quality & EHS Management: Defining Quality, Construction Project Quality, Quality Management System, 7 Quality Tools.
Module 4.10	Control Chart & Cost of Quality. Introduction to Occupational Health, Safety and Environment.
4.11	Windchill License Management
4.12	Daily System Monitoring Tasks
4.13	Weekly System Monitoring Tasks
4.14	Monthly System Monitoring Tasks
4.15	Setting Up the Client Environment
4.16	Miscellaneous System Enhancements, Quiz-4
Module 5.1	**Project Risk Management:** Risk Introduction, Risk Analysis.
Module 5.2	Risk Response Strategy and Implementation.
5.3	Revision and Doubt Clearing with Project Work
5.4	Revision and Doubt Clearing with Project Work
5.5	Revision and Doubt Clearing with Project Work
5.6	Revision and Doubt Clearing with Project Work
5.7	Revision and Doubt Clearing with Project Work
5.8	Revision and Doubt Clearing with Project Work
Module 5.9	**Project Monitoring & Control:** Introduction to Project Monitoring and Controlling, Analysis Techniques.
Module 5.10	Visualization Techniques, Elements of Control, Monitor and Control Schedule, Cost and Resources.
5.11	Project Work
5.12	Project Work
5.13	Project Work
5.14	Project Work
5.15	Project Work
5.16	Project Work, Quiz-5

Course outcome: After completion of the course, the student will be able to

CO 1	To integrate systematic approaches of innovative product lifecycle management using design thinking with an awareness of business considerations needed to produce products.	K3

CO 2	To develop ability to employ state-of-the-art technology in product and process development and be PLM proficient.	K3
CO 3	To develop skills to support product realization, including prototype, testing, validation and marketing.	K3
CO4	To introduce the latest trends and technology in digital manufacturing.	K3
CO 5	To familiarize with the concepts of PLM strategy and application.	K3
Link: NPTEL/ YouTube/ Faculty Video Link:		
https://youtu.be/HN9GtL21rb4		
https://archive.nptel.ac.in/courses/110/104/110104084/		
https://archive.nptel.ac.in/courses/110/104/110104084/		
https://archive.nptel.ac.in/courses/110/104/110104084/		
https://youtu.be/dcup4kRxSEs		

B.TECH THIRD YEAR

Course Code	BME0663	L	T	P	Credit
Course Title	Industrial Automation and IOT (Workshop Mode)	0	0	6	3

Pre-requisites: Basic of mechanics, foundational knowledge of AI, robotics, IOT systems, sensors, etc..

Course Contents / Syllabus

Suggested list of Experiment

Sr. No.	Name of Experiment
1.1	Study of Cut Sections and Magnetic symbols used in pneumatic circuits
1.2	Operation of a single acting cylinder
1.3	Operation of a double acting cylinder
1.4	Impulse pilot operation of single acting cylinder
1.5	Maintained pilot operation of single acting cylinder
1.6	Operation of single acting cylinder using dual pressure (AND) valve
1.7	Operation of single acting cylinder - controlled from different positions using shuttle (OR) valve
1.8	Operation of double acting cylinder using quick exhaust valve
1.9	Controlling the speed of double acting cylinder using METERING IN flow control valve
1.10	Controlling the speed of double acting cylinder using METERING OUT flow control valve
1.11	Operation of double acting cylinder using memory valve
1.12	Single cycle operation of a double acting cylinder using limit switch & memory valve
1.13	Single & Multi cycle operation of a double acting cylinder using limit switch & memory valve (use sensor reference for simplified circuitry)
1.14	Single cycle automation of multiple cylinders in sequence (Sequence of motion: A+B+A-B-)
1.15	Single cycle automation of multiple cylinders using cascading method (Sequence of motion: A+B+B-A-)
1.16	Single cycle automation of multiple cylinders using cascading method (Sequence of motion: A+A-B+B-)
2.1	Operation of a single acting cylinder using single solenoid valve (direct actuation of solenoid)
2.2	Operation of a double acting cylinder using single solenoid valve (direct actuation of solenoid)
2.3	Operation of a single acting cylinder using single solenoid valve (use relay for solenoid actuation)
2.4	Operation of a double acting cylinder using single solenoid valve (use relay for solenoid actuation)
2.5	Apply AND logic using two manual controls for forward stroke of a double acting cylinder (direct actuation of solenoid)
2.6	Apply OR logic using two manual controls for forward stroke of a double acting cylinder (direct actuation of solenoid)
2.7	Apply AND logic using two manual controls with relay for forward stroke of a double acting cylinder (use relay for solenoid actuation)
2.8	Apply OR logic using two manual controls with relay for forward stroke of a double acting cylinder (use relay for solenoid actuation)
2.9	Operation of a double acting cylinder using single solenoid valve (use separate manual controls for forward stroke and return stroke)
2.10	Operation of a double acting cylinder using double solenoid valve (use separate manual controls for forward stroke and return stroke)
2.11	Operation of a double acting cylinder using single solenoid valve. Forward stroke should be manual & return stroke should be automatic as it reaches forward end
2.12	Operation of a double acting cylinder using double solenoid valve. Forward stroke should be manual & return stroke should be automatic as it reaches forward end
2.13	Continuous operation of a double acting cylinder using double solenoid valve
2.14	Two double acting cylinders are to be operated electropneumatically (Sequence of motion: A+B+A-B-)
2.15	Two double acting cylinders are to be operated electropneumatically (Sequence of motion: A+B+B-A-)
2.16	Perform operations on Modular Manufacturing Systems based on concept of Industry 4.0
3.1	Study of Healthcare based sensors such as:- ECG – Electrocardiogram ACC – Accelerometer, TEMP – Temperature, RESP – Respiration, Heartbeat sensor.
3.2	Study of Agriculture based sensors such as:- Temperature, Humidity, Pressure Sensor, Soil Temperature, Soil Moisture,

	Rain sensor.
3.3	Study of Healthy Environment based sensors such as:- PIR Motion sensor. Air quality sensor, Fire sensor, Accelerometer, Gyroscope sensor, Gas sensors, Light sensors.
3.4	Study of various IoT components.
4.1	Write a program to blink an LED using Arduino.
4.2	Write a program to identify object distance using Ultrasonic sensor & Arduino Uno.
4.3	Write a program to read temperature and humidity using DHT-11 & Arduino Uno.
4.4	Write a program to read and display sensor value of MQ135 gas sensor using Arduino Uno.
4.5	Write a program to connect LDR with Arduino Uno.
4.6	Write a program to connect potentiometer with Arduino Uno.
4.7	To interface motor using relay with Arduino and write a program to turn motor ON/OFF./
4.8	To interface sensors to Arduino and display the sensor data.
4.9	To interface sensor with Arduino and write a program to turn ON/OFF Solenoid valve when sensor data is detected.
5.1	To interface sensor with Arduino and write a program to turn ON/OFF Linear Actuator when sensor data is detected.
5.2	To interface Arduino to a Bluetooth Module and send sensor data to a smart phone using Bluetooth.
5.3	Write a program to connect HC-05 Bluetooth with Arduino and controlling LED using BLYNK.
5.4	Write a program to send data to ThingSpeak server using NodeMCU & DHT-11 sensor.
5.5	Develop an IoT based Smart water flow system.
5.6	Develop an IoT based smart lock system for Motorcycle/Car/Household door

Course outcome: After completion of the course, the student will be able to

CO 1	Use and perform experiments based on Pneumatic Trainer kit	K2
CO 2	Use and perform experiments based on Electro-Pneumatic trainer kit and Modular manufacturing system	K2
CO 3	Gain knowledge of IoT sensors and Study various IoT components	K2
CO4	Understand how to connect the controller, sensors and actuators for different applications	K2
CO 5	Implement the IoT knowledge in different activities and projects.	K2

B.TECH THIRD YEAR

Course Code	BME0651	L	T	P	Credit
Course Title	REFRIGERATION AND AIR CONDITIONING LAB	0	0	2	1

Pre-requisites: knowledge of Thermodynamics

Course Contents / Syllabus

Suggested list of Experiment

Sr. No.	Name of Experiment
1	Experiment on refrigeration test rig and calculation of various performance parameters.
2	To study different types of expansion devices used in refrigeration system.
3	To study different types of evaporators used in refrigeration systems.
4	To study basic components of air-conditioning system.
5	Experiment on air-conditioning test rig & calculation of various performance parameters.
6	Experiment on water cooling tower to evaluate its performance
7	Study of window air conditioner.
8	To study different types of compressors used in refrigeration and air conditioning systems.
9	Visit of a central air conditioning plant and its detailed study.
10	Visit of cold-storage and its detailed study.
11	Experiment on Desert coolers.
12	To study different types of condensers used in refrigeration and air conditioning systems.

Course outcome: After completion of the course, the student will be able to

CO 1	Demonstrate practical understanding of Simple vapour compression refrigeration system	K2
CO 2	Demonstrate working understanding of types of evaporators, condensers, compressors and expansion devices used in refrigeration system.	K2
CO 3	Analyze and calculate the performance of refrigeration test rig.	K2
CO4	Calculate coefficient of performance of air-conditioning test rig.	K3
CO 5	Demonstrate the complete working of window air conditioner.	K2

B.TECH THIRD YEAR		
Subject Code: BME0611		**L T P: 3 0 0**
Subject Name: Smart Manufacturing		**Credits: 3**
Pre- requisites: Basic manufacturing processes, foundational knowledge of AI, robotics and IOT systems.		
Course Contents/Syllabus		
Unit-1	1.1. Introduction to IIoT system and its architecture. 1.2. Sensor Technologies and Data Acquisition Systems 1.3. Cloud computing, Edge computing and Fog computing 1.4. IIoT Applications in Forming: Real-time Process Monitoring and Adaptive Control 1.5. IIoT Applications in Casting: Mold Monitoring and Defect Prediction 1.6. IIoT Applications in Machining: Tool Condition Monitoring and Predictive Maintenance 1.7. IIoT Applications in Assembly: Smart Assembly Lines and Error-Proofing 1.8. IIoT Applications in Additive Manufacturing: Process Monitoring and Quality Control	**8 hours**
Unit-2	2.1. AI and ML Fundamentals for Manufacturing Applications 2.2. Supervised, Unsupervised and Reinforcement Learning in Manufacturing 2.3. AI Applications in Forming: Predictive Modeling for Process Parameters and Defect Prevention 2.4. AI Applications in Casting: Optimization of Casting Parameters and Microstructure Prediction 2.5. AI Applications in Machining: Adaptive Control and Machining Parameter Optimization 2.6. AI Applications in Assembly: Defect Detection and Quality Inspection 2.7. AI Applications in Additive Manufacturing: Process Parameter Optimization and Part Quality Prediction 2.8. Deep Learning for Manufacturing Process Vision Systems	**8 hours**
Unit-3	3.1. Digital Twin Fundamentals and Architecture 3.2. Types and components of Digital twins 3.3. Data Integration and Model Synchronization 3.4. Digital Twins in Forming: Virtual Process Design and Real-time Process Control 3.5. Digital Twins in Casting: Mold Design Optimization and Solidification Simulation 3.6. Digital Twins in Machining: Virtual Machining and Fixture Design 3.7. Digital Twins in Assembly: Assembly Sequence Planning and Virtual Commissioning 3.8. Digital Twins in Additive Manufacturing: Build Process Simulation and Part Performance Prediction 3.9. Factory-level Digital Twins for Production Planning and Control	**8 hours**
Unit-4	4.1. Introduction to Applied Industrial Robotics, types and historical development. 4.2. Collaborative Robots (Cobots), Safety, Programming and Applications 4.3. Autonomous Mobile Robots (AMRs) and Automated Guided Vehicles (AGVs) 4.4. Robotics in Forming: Automated Loading/Unloading and In-process Adjustments 4.5. Robotics in Casting: Mold Preparation, Pouring, and Finishing Operations 4.6. Robotics in Machining: Robot-assisted Machining and Automated Workpiece Handling 4.7. Robotics in Assembly: Flexible Assembly Systems and Human-Robot Collaboration 4.8. Robotics in Additive Manufacturing: Multi-axis 3D Printing and Hybrid Manufacturing 4.9. End Effector Design for various manufacturing applications	**8 hours**
Unit-5	5.1. Augmented/Virtual Reality (AR/VR): Principles and Manufacturing Applications 5.2. AR/VR Applications: Design Visualization, Training, and Maintenance Support 5.3. Blockchain Technology: Fundamentals and Distributed Ledger Systems 5.4. Blockchain Applications: Supply Chain Traceability and Digital Product Passports 5.5. Big Data Analytics: Introduction, Architecture and Manufacturing Data Pipelines 5.6. Big Data Applications: Production Optimization and Quality Control 5.7. Manufacturing Execution Systems (MES): Integration with Shop Floor Systems 5.8. Cybersecurity for Smart Manufacturing: Threat Assessment and Mitigation, Protecting Critical Manufacturing Infrastructure	**8 hours**

Course Outcomes – After completion of the course, the student will be able to

CO1	Understand the role of IIoT sytems in manufacturing.	K2
CO2	Learn and apply concepts of AI and ML in the manufacturing processes.	K2
CO3	Understand the importance and role of digital twin technology in industry.	K2

CO4	Understand the functions of robotics and automation in manufacturing	K2
CO5	Gain knowledge over other emerging technologies that helps making manufacturing smart.	K1

Text Books:

Industry 4.0: The Industrial Internet of Things. Apress.

Automation, Production Systems, and Computer-Integrated Manufacturing. Pearson.

Deep Learning. MIT Press.

Automated Manufacturing Systems with PLCs, Hugh Jack

Reference Books:

Digital Twin: Manufacturing Excellence through Virtual Factory Replication. White Paper.

Springer Handbook of Robotics. Springer.

Cloud-Based Cyber-Physical Systems in Manufacturing. Springer

Links: NPTEL/You Tube/Web Link

https://youtu.be/wspWyKbqY7A?si=FXNQkOtJfxpWMk8D

https://youtu.be/4d3vWhyWEic?si=JQYW1hMDX3jyYAoM

https://youtu.be/ObGhB9CCHP8?si=8tnTuKnl30MLslwm

https://youtu.be/AX01c8ad_BE?si=aokTFNc5m_hnXCe3

https://youtu.be/lzktCpbxT8g?si=19auukK6XMQMvJ7M

B.TECH THIRD YEAR

Subject Code: BME0613	**L T P: 3 0 0**
Subject Name: Machine Learning in manufacturing	**Credits: 3**

Pre- requisites: Statistics & Probability

Course Contents/Syllabus

Unit-1	Introduction to Machine Learning, Types of Machine Learning, and Applications of ML in Mechanical Engineering, Designing a Learning System, Performance Measures for ML Model, Issues in Machine Learning, application of machine learning in manufacturing.	**8 hours**
Unit-2	Supervised Learning, Classification, Regression Analysis and its Types, Model Selection Procedures, Bayesian Decision Theory, Naïve Bayes Classifier, Bayes Optimal Classifier, evaluating an Estimator: Bias and Variance, Support Vector Machines, Types of Support Vector Kernel (Linear Kernel, Polynomial Kernel, Gaussian Kernel, Issues in SVM, use of regression and classification approach in manufacturing. Decision Trees: Basics of Decision Tree, Issues in Decision tree learning, ID3 Algorithm, Information gain and Entropy.	**8 hours**
Unit-3	Unsupervised Learning: Introduction to Unsupervised Learning, Cluster Analysis, K-Means Clustering, KNN, Expectation-Maximization Algorithm, Dimensionality Reduction: Principal Components Analysis, Independent Component Analysis, Multidimensional Scaling, Linear Discriminant Analysis, implementation and analysis of clustering in manufacturing.	**8 hours**
Unit-4	Introduction to Neural Networks: ANN, RNN, Perceptron, The Back Propagation Algorithm, Concept of Convolution Neural Networks, Types of Layers of CNN, case study: Neural network use to builds autonomous manufacturing system Evolutionary Computing, Simulated Annealing, Random Search, Downhill Simplex Search, Swarm optimization, ant colony optimization, bee colony optimization.	**8 hours**
Unit-5	Introduction to Neural Networks: ANN, RNN, Perceptron, The Back Propagation Algorithm, Concept of Convolution Neural Networks, Types of Layers of CNN, case study: Neural network use to builds autonomous manufacturing system Evolutionary Computing, Simulated Annealing, Random Search, Downhill Simplex Search, Swarm optimization, ant colony optimization, bee colony optimization.	**8 hours**

Course Outcomes –

CO1	Understanding utilization and implementation proper machine learning algorithm.	K2
CO2	Understand and apply the basic supervised machine learning algorithms.	K3
CO3	Understand and apply the basic unsupervised machine learning algorithms.	K3
CO4	Understand and implement various neural network models.	K3
CO5	Understand and apply the reinforcement learning algorithms.	K3

Text Books:

Machine Learning: A Constraint-Based Approach, Morgan Kaufmann. 2017

Machine Learning: The New AI, MIT Press-2016

"Machine Learning", McGraw-Hill, 2010

Reference Books:

Machine Learning: An Artificial Intelligence Approach, Volume 1, Elsevier. 2014

Introduction to Machine Learning (Adaptive Computation and Machine Learning)", The MIT Press.

Links: NPTEL/You Tube/Web Link
https://www.youtube.com/watch?v=P0fJ0ECTMRY&list=PLEq2lkfJdUyYrDeEyYQkI8tFH9dwypuxj&index=61
https://www.youtube.com/watch?v=EthRahJIUhE&list=PLEq2lkfJdUyYrDeEyYQkI8tFH9dwypuxj&index=62
https://www.youtube.com/watch?v=OF3P64JQgOs&list=PLEq2lkfJdUyYrDeEyYQkI8tFH9dwypuxj&index=63
https://www.youtube.com/watch?v=A8K_RykoWFc&list=PLEq2lkfJdUyYrDeEyYQkI8tFH9dwypuxj&index=65
https://www.youtube.com/watch?v=JJ6hR9Itj4&list=PLEq2lkfJdUyYrDeEyYQkI8tFH9dwypuxj&index=64

B.TECH THIRD YEAR

Subject Code: BME0612	**L T P: 3 0 0**
Subject Name: Automotive Transmission & Suspension Systems	**Credits: 3**

Pre- requisites: Basic knowledge of Mechanics of Machines and Automotive Engineering

Course Contents/Syllabus

Unit-1	Function and necessity of transmission in automobiles; Classification of transmission systems (manual, automatic, CVT, etc.); Layout of power transmission from engine to wheels; Clutches: Single Plate Clutch, Multi-Plate Clutch, Cone Clutch, Centrifugal Clutch, Diaphragm Clutch Working principle and comparison of clutches; Torque Converters and Fluid Couplings; Clutch lining materials, friction considerations, and heat dissipation.	**8 hours**
Unit-2	Gearbox types: Sliding mesh, Constant mesh, Synchromesh gearboxes; Gear ratio and torque multiplication; Epicyclic gear trains: working and gear calculations; Construction and working of automatic transmissions; Overview of CVT and Dual Clutch Transmissions (DCT); Comparison of manual vs. automatic transmissions in terms of performance, efficiency, and control.	**8 hours**
Unit-3	Propeller shafts: construction and balancing; Universal joints and slip joints; Differentials: Open, Limited slip, Locking; Rear and front axle layouts; Working of 4WD and AWD systems; Transaxles: integration of gearbox and differential; Transfer case, torque split control, and cross-axle locking.	**8 hours**
Unit-4	Suspension objectives: ride comfort, stability, load isolation; Types of suspension systems: dependent and independent; Springs: Leaf, Coil, Torsion bar, Air springs; Suspension geometry and vehicle dynamics: Camber, Caster, Toe-in and Toe-out, Kingpin inclination; Shock absorbers and dampers: hydraulic, gas-charged, twin-tube, mono-tube; Suspension kinematics and effect on handling.	**8 hours**
Unit-5	Active Suspension Systems: components and working; Semi-active and adaptive suspensions; Hydro - pneumatic and electro-pneumatic suspension systems; Electronic control systems for suspension: Sensors (accelerometers, position sensors), Actuators, ECU (Electronic Control Unit); Case Studies: McPherson Strut, Multi-link suspension; Introduction to ride and handling simulation, suspension testing methods	**8 hours**

Course Outcomes – After completion of the course, the student will be able to

CO1	Explain transmission system types, clutch applications, and torque converter functions.	K2
CO2	Analyze gear train layouts, gear ratios, and compare manual vs. automatic transmissions.	K4
CO3	Describe propeller shafts, differentials under dynamic conditions, and 4WD/AWD systems.	K2
CO4	Identify suspension types, their geometry impact on vehicle dynamics, and spring-damper use.	K2
CO5	Distinguish suspension types, understand electronic control systems, and analyze advanced suspension applications.	K4

Text Books:

Automobile Engineering Vol. I & II, Standard Publishers

Automobile Engineering, Satya Prakashan

Advanced Vehicle Technology, Butterworth-Heinemann

Reference Books:

Automotive Suspension and Steering Systems, Delmar Cengage

Automotive Mechanics, Tata McGraw Hill

Transmission, Chassis and Related Systems, Butterworth-Heinemann

Links: NPTEL/You Tube/Web Link

https://onlinecourses.nptel.ac.in/noc24_de03/preview

https://archive.nptel.ac.in/courses/107/106/107106088/

https://nptel.ac.in/courses/107106088

http://kcl.digimat.in/nptel/courses/video/107106088/L66.html
https://www.youtube.com/watch?v=GinzMttVE1M

B.TECH THIRD YEAR	
Subject Code: BME0614	**L T P: 3 0 0**
Subject Name: Automotive Manufacturing and Materials	**Credits: 3**

Pre- requisites: Foundational knowledge in mechanical engineering and materials science.

Course Contents/Syllabus

Unit-1	Overview of automotive manufacturing; Evolution of automotive manufacturing technologies; Manufacturing systems in the automotive industry; Materials used in automotive manufacturing; Process selection criteria; Automation and Robotics in automotive manufacturing.	**8 hours**
Unit-2	Chassis & Frame: Steel/aluminum; stamping, welding, hydroforming, coating BIW: Steel/aluminum/composites; stamping, welding, bonding Engine & Powertrain: Cast iron/aluminum; casting, forging, machining, heat treatment Transmission: Alloy steel/aluminum; gear cutting, broaching, forging Suspension: Steel/aluminum/rubber; forging, heat treatment, molding Brakes: Cast iron/aluminum; casting, sintering, machining Steering: Steel/aluminum; machining, casting, molding, assembly	**8 hours**
Unit-3	Fuel & Exhaust: Steel/plastic/ceramic; forming, welding, molding, coating Electrical Systems: Copper/plastic; harnessing, PCB soldering, molding Interior: ABS/foam/leather; molding, stitching, welding Exterior: Sheet metal/plastics; stamping, injection molding, painting	**8 hours**
Unit-4	Vehicle Assembly and Integration: Assembly stages: Body-in-white (BIW), Paint Shop, Trim, Chassis, and Final Assembly Subsystem assembly: engine, transmission, suspension, electricals, interiors, HVAC Tools and equipment: jigs, fixtures, robots, fastening techniques (welding, adhesives, bolts, rivets) Assembly Line Design and Optimization: Types of lines: Manual, Semi-automated, fully automated; Takt time, line balancing, synchronous and asynchronous flow systems Ergonomics, material handling, and conveyor systems in line design	**8 hours**
Unit-5	Automation and Smart Manufacturing: Use of robotics and AGVs in body and final assembly; Industry 4.0 tools: sensor networks, PLCs, IoT, and AI integration; Predictive maintenance and real-time data monitoring in smart factories; Quality Assurance and Testing: In-line and end-of-line inspection techniques; Functional testing: emissions, brakes, water leak, roadworthiness; Statistical Process Control (SPC), Six Sigma, and defect management	**8 hours**

Course Outcomes – After completion of the course, the student will be able to

CO1	Understand the fundamentals of automotive manufacturing, its history, and the materials involved.	K2
CO2	Identify materials and manufacturing processes used in structural and mechanical vehicle systems.	K2
CO3	Explain manufacturing techniques for auxiliary, electrical, interior, and exterior vehicle systems. .	K2
CO4	Describe the stages of vehicle assembly and integration, and explain the design and optimization of various types of automotive assembly lines.	K2
CO5	Analyze the role of automation, Industry 4.0 tools, and quality assurance techniques in enhancing vehicle manufacturing efficiency and reliability.	K4

Text Books:

"Introduction to Manufacturing Processes"

"Manufacturing Processes for Engineering Materials"

"Materials Science and Engineering: An Introduction"

"Principles of Materials Science and Engineering"

Reference Books:

Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Wiley. (2015),

Manufacturing Engineering and Technology, Pearson. (2014),

Manufacturing Processes for Engineering Materials, Pearson. (2019),

Fundamentals of Engineering Materials, McGraw-Hill. (2014),

Engineering Materials 1: An Introduction to Properties, Applications, and Design, Butterworth-Heinemann. (2012),

Links: NPTEL/You Tube/Web Link

https://archive.nptel.ac.in/courses/107/106/107106088/

https://archive.nptel.ac.in/courses/112/107/112107219/

https://archive.nptel.ac.in/courses/112/103/112103293/

https://www.youtube.com/watch?v=2rxbxNem1iI&list=PLyqSpQzTE6M_ON8uXt-PP8uX6hMWJeYSJ

https://www.youtube.com/watch?v=KMcsjCXfLQw&list=PLyAZSyX8Qy5Am_2StOOQ5vCUE3VIcAenE

B.TECH THIRD YEAR	
Subject Code: BNC0601	**L T P: 2 0 0**
Subject Name: ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	**Credits: 2**

Pre- requisites:

Course Contents/Syllabus

Unit-1	SOCIETY STATE AND POLITY IN INDIA: State in Ancient India: Evolutionary Theory, Force Theory, Mystical Theory Contract Theory, Stages of State Formation in Ancient India, Kingship , Council of Ministers Administration Political Ideals in Ancient India Conditions' of the Welfare of Societies, The Seven Limbs of the State, Society in Ancient India, Purusārtha, Varnāshrama System, Āshrama or the Stages of Life, Marriage, Understanding Gender as a social category, The representation of Women in Historical traditions, Challenges faced by Women.	**8 hours**
Unit-2	INDIAN LITERATURE, CULTURE, TRADITION, AND PRACTICES: Evolution of script and languages in India: Harappan Script and Brahmi Script. The Vedas, the Upanishads, the Ramayana and the Mahabharata, Puranas, Buddhist And Jain Literature in Pali,Prakrit And Sanskrit, Sikh Literature, Kautilya's Arthashastra, Famous Sanskrit Authors, Telugu Literature, Kannada Literature,Malayalam Literature ,Sangama Literature Northern Indian Languages & Literature, Persian And Urdu ,Hindi Literature	**8 hours**
Unit-3	INDIAN RELIGION, PHILOSOPHY, AND PRACTICES: Pre-Vedic and Vedic Religion, Buddhism, Jainism, Six System Indian Philosophy, Shankaracharya, Various Philosophical Doctrines , Other Heterodox Sects, Bhakti Movement, Sufi movement, Socio religious reform movement of 19th century, Modern religious practices.	**8 hours**
Unit-4	SCIENCE, MANAGEMENT AND INDIAN KNOWLEDGE SYSTEM: Astronomy in India, Chemistry in India, Mathematics in India, Physics in India, Agriculture in India, Medicine in India , Metallurgy in India, Geography, Biology, Harappan Technologies, Water Management in India, Textile Technology in India ,Writing Technology in India Pyrotechnics in India Trade in Ancient India/,India's Dominance up to Pre-colonial Times	**8 hours**
Unit-5	CULTURAL HERITAGE AND PERFORMING ARTS: Indian Architect, Engineering and Architecture in Ancient India, Sculptures, Pottery, Painting, Indian Handicraft, UNESCO'S List of World Heritage sites in India, Seals, coins, Puppetry, Dance, Music, Theatre, drama, Martial Arts Traditions, Fairs and Festivals, UNESCO'S List of Intangible Cultural Heritage, Calenders, Current developments in Arts and Cultural, Indian's Cultural Contribution to the World. Indian Cinema.	**8 hours**

Course Outcomes – After completion of the course, the student will be able to

CO1	Understand the basics of past Indian politics and state polity	K1
CO2	Understand the Vedas, Upanishads, languages & literature of Indian society.	K2
CO3	Know the different religions and religious movements in India.	K4
CO4	Identify and explore the basic knowledge about the ancient history of Indian agriculture, science & technology, and ayurveda.	K4
CO5	Identify Indian dances, fairs & festivals, and cinema	K4

Text Books:

. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014.

S. Baliyan, Indian Art and Culture, Oxford University Press, India

Nitin Singhania, Indian Art and Culture: for civil services and other competitive Examinations,3rd Edition,Mc Graw Hill

Reference Books:

Romila Thapar, Readings In Early Indian History Oxford University Press, India

Basham, A.L., The Wonder that was India (34th impression), New Delhi, Rupa & co.