Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Technology**	Semester: **VIII**
Branch: **Mechanical Engineering**	Subject Code: **D037811(037)**
Subject: **Robotics**	Total Tutorial Periods: **01**
Total Theory Periods: **03**	Maximum Marks**: 100**
Class Tests: **Two(Minimum)**	Minimum Marks: **35**
Assignments: **Two(Minimum)**	ESE Duration: **Three Hours**

Course Objectives:

The main objective of the course is to impart an understanding of fundamentals of robotics, theory of robot design and their applications.

UNIT-I	**Introduction:** Fixed & flexible automation, evolution of robots and robotics, laws of robotics, progressive, advancement in robots, manipulator anatomy, arm configuration & workspace, human arm characteristics, design and control issues, manipulation and control, actuators, sensors and vision, programming of robots, applications material handling, processing applications, assembly applications, inspection applications etc, the future prospects, notations.
UNIT-II	**Coordinate Frames, Mapping and Transforms:** Coordinate frames, description of objects in space, transformation of vectors, inverting a homogeneous transform, fundamental rotation matrices. Mechanical structure and notations, description of links and joints, kinematic modeling of the manipulator.
UNIT-III	**Kinematic Modeling of Robots:** Denavit Hartenberg notation, kinematic relationship between adjacent links, manipulator transformation matrix. Position analysis - direct and inverse kinematic models of robotic manipulators, various examples, velocity analysis-Jacobian matrix, introduction to inverse kinematic model.
UNIT-IV	**Robotic Sensors and Vision:** Introduction regarding sensing technologies, sensors in robotics, classification, characteristics, internal sensors – position, velocity, acceleration sensors, force sensors, external sensors–proximity, touch and slip sensors. Robotic vision, process of imaging, architecture of robotic vision systems, image acquisition, components of vision system, image representation, image processing
UNIT-V	**Motion Planning and Control of Robot Manipulators:** Trajectory planning of robotic manipulator: joint space and Cartesian space techniques. Open and close loop control, linear control schemes, examples of control models. **Robot applications:** Industrial applications, material handling, processing applications, assembly applications, inspection application, principles for robot application and application planning, justification of robots, robot safety, non-industrial applications, and robotic application for sustainable development.

Text Books:

1.	Robotics & Control–R.K.Mittal & I.J.Nagrath–TMH Publications.
2.	Introduction to Robotics Analysis, Systems Applications-Saced B .Niku, Pearson

Reference Books:	
1.	Principle of Robot Motion-Choset–PHI, Delhi
2.	Kinematics and Synthesis of linkages–Hartenberg and Denavit–McGrawHill.
3.	Robotics Control Sensing-Vision and Intellgence – K.S.Fu, McGrawHill.
4.	Robotic Engineering–An Integrated Approach-R.D.Klafter– PHI.Delhi.
5.	Introduction to Robotics- S.K.Saha – McGraw Hill.
6.	Introduction to Robotics–Mechanics and Control-John J.Craig

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1.	Demonstrate the basic knowledge of terminologies, characteristics, components and applications of robotics systems.
2.	Apply spatial transformation to obtain forward kinematics equation of robot manipulators.
3.	Perform position analysis and velocity analysis of direct and inverse kinematic models of robots.
4.	Describe sensing technologies and robotics vision system and choose the appropriate for a given application.
5.	Develop and analyze the mathematical model for motion planning and control of robot manipulators and describe robotics applications.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Technology**	Semester: **VIII**
Branch: **Mechanical Engineering**	Code: **D037831(037)**
Subject: **Automobile Engineering**	Total Tutorial Periods: **01**
Total Theory Periods: **02**	Maximum Marks**: 100**
Class Tests: **Two (Minimum)**	Minimum Marks: 35
Assignments: **Two (Minimum)**	ESE Duration: **Three Hours**

Course Objectives:

The main objective of the course is to impart an understanding of the basic structure of an automobile and its suspension system, transmission system, braking system, steering system and electrical system.

UNIT-I	**Vehicle structure:** Type of automotive vehicles, general layout, vehicle construction-chassis, frame and body, types of frames, frameless and unitary construction, position of power unit. **Suspension system :**Objects & principles of suspension, system, types, rigid axle suspension & Independent suspension for front & rear ends, simple & double arm parallel & perpendicular type of suspension system. Gas filled suspension system. **Springs -** Purpose, types viz. leaf, coiled, rubber, air, suspension system, torsion bar, stabilizer, telescopic damper.
UNIT-II	**Clutches:** Characteristics, functions, principles of operation of clutch, friction clutch, single-plate, multi-plate, centrifugal clutch, positive clutch, friction plate clutch lining materials. Torque transmitted and related problems. **Fluid flywheel:** Construction, working principles & characteristics.
UNIT-III	**Gear Box** - Object of Gear Box, air, rolling & gradient resistance, tractive effort variation with speed, performance curve. **Types of Gear Boxes** - Sliding mesh, constant mesh, synchromesh device, automatic transmission, overdrive, lubrication of gear box. **Torque Converter** - Principles of working, characteristics, Torque converter with direct drive. **Testing of Automobiles**
UNIT-IV	**Universal Joint -** Types, propeller shaft, slip joint. **Differential** – Functions, single & double reduction differential, limited slip differential. **Front Axle** - Live & dead axle, stub axle. **Back Axle** – Hotchkiss drive, torque tube drive. **Tyres -** Types specification, causes of tyre wear & rim. **Brakes & Braking system** - Purpose, principles, layout of braking system. Classification, mechanical, hydraulic, master cylinder, Tandem master cylinder, wheel cylinder, self energizing & self adjusting brakes, disc brakes, antiskid brakes, power operated brakes.
UNIT-V	**Steering system**:- Gear & links, types of steering gears, reversibility of steering, center point steering, steering geometry viz. castor, camber, king pin inclination toe in, toe out, cornering power, under-over steer; power steering, effect of shimmy, condition of true rolling, calculation of turning radius. Correct steering equation and related problems. **Electrical System**: Battery: construction, maintenance, testing and charging. Cut-out, lighting circuit, horn, signals etc.

Text Books:	
1	Automobile Engineering – Kripal Singh – Standard Publications, New Delhi
2	Automobile Mechanics - N. K. Giri – Khanna Publishers, New Delhi

Reference Books:	
1	Automobile Engineering – G.B.S. Narang – Khanna Publishers, New Delhi
2	Automotive Mechanics: Principles and Practices- W.H.Crouse, and D.L. Anglin, TMH
3	Automobile Engineering – K. R. Govindan – Anuradha Agencies
4	The Automobile-Harbans, Reyat Singh- S.Chand , New Delhi
5	Automotive Mechanics – Joseph Heitner-CBS Pub., New Delhi
6	Motor Vehicle – Newton & Steeds – Life & Sons Limited.

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1	Describe the basic structure of an automobile with applied engineering principle in its design.
2	Describe clutches and fluid flywheel and solve related problems.
3	Describe construction and working principle of gear box and torque converter and analyze problem related automobile performance.
4	Describe construction and working of propeller shaft, differential, axle assembly, tyres and braking system of an automobile
5	Describe construction and working of steering and electrical systems with applied engineering principle in its design.

Chhattisgarh Swami Vivekanand Technical University, Bhilai

Name of program: **Bachelor of Technology**	Semester: **VIII**
Branch: **Mechanical Engineering**	Code: **D037832(037)**
Subject: **Computational Fluid Dynamics**	Total Tutorial Periods: **01**
Total Theory Periods: **02**	Maximum Marks**: 100**
Class Tests: **Two (Minimum)**	Minimum Marks: **35**
Assignments: **Two (Minimum)**	ESE Duration: **Three Hours**

Course Objectives: The main objective of the course is to introduce the students to widely used techniques in the numerical solution of fluid equations, issues that arise in the solution of such equations, and modern trends in CFD.

UNIT-I	**Fundamental Concepts:** Introduction- Governing Equations of Fluid Dynamics. Mathematical Behavior of Partial Differential Equations - Elliptic, Parabolic and Hyperbolic equations. Physical Classification of fluid dynamics problems, Well-posed problems.
UNIT-II	**Finite Element and Finite Difference Method:** Overview of Finite Element and Finite difference Techniques in Computational Fluid Dynamics. Strong and Weak Formulations of a Boundary Value Problem.
UNIT-III	**Finite Volume Schemes:** General Discretization Methodologies: Cell Centered Formulation- Lax-Vendoroff Time Stepping, Runge-Kutta Time Stepping, Multi-stage Time Stepping. Cell Vertex Formulation - Multistage Time Stepping. Discretization of convective fluxes: Flux-vector splitting formulation, Flux-difference splitting formulation. Up-wind formulation.
UNIT-IV	**Discretization:** Boundary layer Equations and methods of solution -Implicit time dependent methods for inviscid and viscous compressible flows - Concept of numerical dissipation –Stability properties of explicit and implicit methods - Conservative up-wind discretization for Hyperbolic systems - Further advantages of upwind differencing.
UNIT-V	**Principles of Grid Generation:** Structured grid: C-, H- and O-Grid topology. Algebraic, Elliptical and Hyperbolic Grid Generation, Unstructured grid: Delaunay Triangulation, Advancing-Front Method, Generation of Anisotropic Grids, Mixed-Element/Hybrid Grids, Assessment and Improvement of Grid Quality.

Text Books:	
1	Introduction to Computational Fluid Dynamics: The Finite Volume Method-Versteeg & Malalasekera-Addison- Wesley.
2	Introduction to Computational Fluid Dynamics – Niyog & Chakraborty – Pearson ,Singapore

Reference Books:	
1	Computational Techniques for Fluid Dynamics, - Vols. I and II - Fletcher C.A.J. – Springer, Verlag, Berlin, 1988.
2	Computational Fluid Dynamics: An Introduction - John F. Wendt (Editor) – Springer, Verlag, Berlin.
3	Numerical Computation of Internal and External Flows, Vols. I and II -Charles Hirsch-John Wiley & Sons,New York.
4	Computational Fluid Dynamics for Engineers, Vols. I & II - . Klaus A Hoffmann and Steve T. Chiang – Engineering Education System, W. Wichita, K.S., 67208 – 1078 USA.
5	Fundamentals of Aerodynamics - Anderson, Jr.D - McGraw Hill.

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1	Discuss the fundamental concepts of computational fluid dynamics.
2	Discuss Finite element and Finite difference Techniques in CFD.
3	Discuss the concept of finite volume schemes.
4	Describe the mathematical basis in the technique of discretization of CFD equations.
5	Discuss the principle of grid generation.

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Name of program: **Bachelor of Technology**	Semester: **VIII**
Branch: **Mechanical Engineering**	Code: **D037833(037)**
Subject: **Product Design and Development**	Total Tutorial Periods: **01**
Total Theory Periods: **02**	Maximum Marks**: 100**
Class Tests: **Two (Minimum)**	Minimum Marks: **35**
Assignments: **Two (Minimum)**	ESE Duration: **Three Hours**

Course Objectives: The main objective of the course is to acquaint the students with the knowledge regarding conceptualization, design and development of a new product.

UNIT-I	**Product Development Process:** Background for design, design theory, design materials, human factors in design applied ergonomics, product development processes and organization, identifying customer needs, establishing product specifications, concept generation and selecting product architecture.
UNIT-II	**Product Design Methods:** Generating concepts, selection of a concept, Testing of concept, product architecture, Creative and rational clarifying objectives- the objective trees methods, establishing functions – the function analysis methods, setting requirement- requirements specification methods determining characteristics – the QFD method, generating alternatives-the morphological chart method, evaluating alternatives-the weighted objectives methods, improving details-the value engineering method and design strategies.
UNIT-III	**Design for Manufacture:** Estimating manufacturing costs, reducing component, assembly and support cost design for assembly, design for disassembly, design for environment, design for graphics and packaging, effective prototyping – principle and planning.
UNIT-IV	**Industrial Design:** Its need - Ergonomic needs, Aesthetic needs, impact, accessing the quality, steps involved in Industrial design process, Management of Technology & user driven products.
UNIT-V	**Patents, Product Development & Project Management:** Legal issues in product design, trademarks, trade-secret, copy rights, patents – types, steps for disclosure, design resources, economics – quantitative & qualitative analysis, management of product development projects, Design Structure Matrix, Gantt Chart, Project schedule, budget, risk plan, accelerating project, execution, assessing and correction, Intellectual property rights

Text Books:	
1	Product Design & Development - Karl. T. Ulrich and Steven D. Eppinger – TMH,Delhi.
2	Product Design – Kevin Otto and Kristin wood - Pearson Education.

Reference Books:	
1	Product Development – Chitale & Gupta - Tata McGraw Hill.
2	Product Design and Manufacturing – Chitale & Gupta – PHI, Delhi.
3	Product Design: Creativity, Concepts and Usability – Kumar – PHI, Delhi .
4	Concurrent Engineering in Product Design and Development- Imad Moustapha – New Age.
5	Operations Management- Monks, J.G - McGraw Hill.
6	Product Design and Development - Ulrich & Eppinger – TMH Delhi.
7	Facility Layout and Location - Francis, R. L., and White, J. A. - Prentice Hall of India

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1	Explain the product development process of a new product.
2	Explain product design methods.
3	Explain the concepts of design for manufacture.
4	Explain the concepts of Industrial design.
5	Discuss legal issue pertaining to product design and management of product development projects.

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Name of program: **Bachelor of Technology**	Semester: **VIII**
Branch: **Mechanical Engineering**	Code: **D037834(037)**
Subject: **Vibration and Noise Control**	Total Tutorial Periods: **01**
Total Theory Periods: **02**	Maximum Marks**: 100**
Class Tests: **Two (Minimum)**	Minimum Marks: **35**
Assignments: **Two (Minimum)**	ESE Duration: **Three Hours**

Course Objectives:

The main objective of the course is to apply knowledge of Vibration & Noise Control for understanding, formulating and solving engineering problems.

UNIT-I	**Fundamentals of Vibrations:** Simple harmonic motion, combination of two simple harmonic motions, beats, Fourier analysis Single degree of freedom system: Free un-damped vibrations: Equivalent systems linear and torsional, natural frequency estimation, energy methods **Damped Vibrations:** Damping models, structural, coulomb, and viscous damping, critically, under and over-damped system, logarithmic decrement **Forced Vibrations:** Harmonic excitation, support motion, vibration isolation, critical speeds of shafts in bending
UNIT-II	**Two Degree of Freedom System:** Free vibrations of spring coupled system, general solution, torsional vibrations, two degree of freedom mass coupled system, bending vibrations in two degree of freedom system, forced vibrations of an undamped two degree of freedom system, dynamic vibration absorber, forced damped vibrations
UNIT-III	**Multi-Degree of Freedom System:** Free un-damped analysis. **Numerical Methods:** Dunkerley's, Rayleigh, Holzer methods. **Experimental Methods in Vibration Analysis:** Vibration measurement devices and analyzers, balancing of rigid rotors
UNIT-IV	**Analysis and Measurement of Sound:** One dimensional wave in a gas, sound perception and the decibel scale, the ear, combining sound levels in decibels, octave bands, loudness, weightings, directionality of acoustic sources and receivers, directivity index
UNIT-V	**Noise Control:** Noise criteria, sound absorption and insulation, noise barriers, acoustic enclosures, silencers

Text Books:	
1	Mechanical Vibrations –Thomson W T- Prentice Hill of India
2	Theory & Practice of Mechanical Vibrations – J.S. Rao, Gupta - New Age International.

Reference Books:	
1	Mechanical Vibrations and Noise Engineering – A G Ambekar – PHI, Delhi
2	Mechanical Vibrations – G.K. Grover - S. Chand & CO.
3	Acoustics for Engineers - Turner &Pretlove - Macmillan
4	Acoustics and Noise Control - Smith, Peters & Owen - Addison-Wesley-Longman.
5	Industrial Noise Control: Fundamentals and Applications - Bell and Bell, Marcel-Dekker
6	Vibration And Noise For Engineers – KewalPujara – DhanpatRai,Delhi

7	Environmental Noise Pollution and its Control – G R Chhatwal – Anmol Publications,Delhi
8	Noise Pollution and Control – Singal S P – Narosa Publications, Delhi
9	Mechanical Vibrations and Noise Controls – Sadhu Singh – Khanna Publisher, New Delhi
10	Fundamentals of Noise and Vibration - Fahy FJ, Walker JG - E&Fnspon – New York

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1	Discuss the fundamentals of vibrations.
2	Discuss the fundamentals of vibration system with two degree of freedom
3	Discuss the fundamentals of vibration system with multi-degree of freedom
4	Demonstrate the ability to analysis and measurements of sound.
5	Discuss noise criteria and control of noise

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Name of program: **Bachelor of Technology**	Semester: **VIII**
Branch: **Mechanical Engineering**	Code: **D037835(037)**
Subject: **Mechanical Handling System and Equipments**	Total Tutorial Periods: **01**
Total Theory Periods: **02**	Maximum Marks**: 100**
Class Tests: **Two (Minimum)**	Minimum Marks: **35**
Assignments: **Two (Minimum)**	ESE Duration: **Three Hours**

Course Objectives: The main objective of the course is to familiarize with concepts of identifying material handling systems and equipment requirements for a specific process and for various locations and working conditions

UNIT-I	**Elements of Material Handling System:** Importance, Terminology, objectives and benefits of better Material Handling, Principles and features of Material Handling System, Interrelationships between material handling and plant layout, physical facilities and other or organizational functions, Classification of Material Handling Equipment.
UNIT-II	**Selection of Material Handling Equipment:** Factors affecting for selection, Material Handling Equation, Choices of Material Handling Equipment, General analysis Procedures, Basic Analytical techniques, the unit load concept Selection of suitable types of systems for applications, Activity cost data and economic analysis for design of components of Material Handling Systems, functions and parameters affecting service, packing and storage of materials.
UNIT-III	**Design of Mechanical Handling Equipment:** Design of Hoists, Drives for hoisting, components, and hoisting mechanisms, rail traveling components and mechanisms, hoisting gear operation during transient motion, selecting the motor rating and determining breaking torque for hoisting mechanisms. Design of Cranes, Hand-propelled and electrically driven E.O.T overheat traveling cranes, Traveling mechanisms of cantilever and monorail cranes, design considerations for structures of rotary and cranes with fixed radius, fixed post and overhead traveling cranes, Stability of stationary rotary and traveling rotary cranes.
UNIT-IV	**Design of Load Lifting Attachments:** Load chains and types of ropes used in Material Handling System, Forged, Standard and Ramshorn Hooks, Crane Grabs and Clamps, Grab Buckets, Electromagnetic Design consideration for conveyor belts, Application of attachments.
UNIT-V	**Study of Systems and Equipment used for Material Storage:** Objectives of storage, Bulk material handling, Gravity flow of solid through slides and chutes, Storage in bins and hoppers, Belt conveyors, Bucket-elevators, Screw Conveyors, cabin vibratory Mobile racks etc.

Text Books:	
1	Material Handling Equipments - N. Rudenko - Peace Publishers, Moscow.
2	Material handling System Design - James M. Apple, John-Wiley Publication, New York

Reference Books:	
1	Materials Handling Principals and Practice - Allegri T H - CBS Publication, New Delhi
2	Material Handling - John R. Immer - McGraw Hill Co. Ltd., New York.
3	Material Handling in Machine shops - Machinery Publication Co. Ltd., London.
4	Material Handling Equipment - M. P. Nexandrn - MIR Publication, Moscow.
5	Bulk Solid Handling - C. R. Cock and J. Mason - Leonard Hill Publication Co. Ltd. U.S.A.

6	Material Handling Hand Book - Kulwiac R. A - John Willy Publication, New York.

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1	Discuss the elements of material handling system.
2	Discuss the factors affecting selection of material handling equipment.
3	Discuss the design considerations of mechanical handling equipment.
4	Discuss the design considerations of load lifting attachments.
5	Describe the systems and equipment used for material storage.

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Name of program: **Bachelor of Technology**	Semester: **VIII**
Branch: **Mechanical Engineering**	Code: **D037836(037)**
Subject: **Numerical Control of Machine Tools**	Total Tutorial Periods: **01**
Total Theory Periods: **02**	Maximum Marks**: 100**
Class Tests: **Two (Minimum)**	Minimum Marks: **35**
Assignments: **Two (Minimum)**	ESE Duration: **Three Hours**

Course Objectives: The main objective of the course is to understand the emergence and development of numerical control machine, characteristics and application areas.

UNIT- I	**Introduction:** Fundamentals of numerical control, advantages limitations of N.C systems -classification of N.C systems. **Computer Numerical Control:** Nomenclature, types and features of CNC machine tools, machine control unit, position control and its significance, engineering analysis of NC positioning systems, open loop and closed loop systems, precision in NC positioning systems-control resolution, accuracy and repeatability. Actuators: servomotors, stepper motors, transducers and feedback elements.
UNIT-II	**Features of NC Machine tools:** Design consideration of N.C machine tools - increasing productivity with N.C machines, tooling for CNC machine. **System Device:** Feedback system-counting devices digital analog converters **Interpolations:** DDA integrators, simple and symmetrical DD reference word CNC interpolators.
UNIT-III	**Part Programming:** Process planning and flow chart for part programming, systems nomenclature and tool geometries, Tool presetting & modular tooling. Selection of tools based on machining capacity, accuracy and surface finish, elements of programming for turning and milling, part programming. Preparatory codes G, miscellaneous functions M, Interpolation, tool compensations, cycles for simplifying programming, typical part programming **Control Loops for NC Systems:** Introduction-control loops for point and counting systems.
UNIT-IV	**Computerized Numerical Control:** CNC concepts-advantage of CNC reference planes, sampled data techniques, microcomputers in CNC. **Adaptive Control Systems:** Adaptive control with optimization and constraints-variable gains AC systems.
UNIT-V	**Modern CNC Machines:** CNC lathes, turning centers, machining centres, automatic pallet changers, automatic tool changers, direct numerical control and applications, CNC machine design features.

Text Books:	
1	Numerical control of machine tool – Koren& Ben Uri – Khanna Publisher,Delhi
2	Automation, Production Systems and Computer Integrated Manufacturing - Groover – PHI.

Reference Books:	
1	CNC Programming - S.K. Sinha - Galgotia
2	Mechatronics - HMT –TMH,Delhi
3	Numerical Control and Computer Aided Manufacturing -Tewari, Rao, Kundra- TMH, Delhi
4	Machine Tool Design and Numerical Control – N.K.Mehta – TMH Delhi
5	Fundamentals of Computer Numerical Control – NIIT – Prentice Hall, Delhi

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1	Discuss the operating principles, components and control of NC/CNC machine tools.
2	Discuss the design features of N.C machine tools.
3	Develop part program for various operations.
4	Discuss CNC concepts & adaptive control systems.
5	Describe modern CNC machines.

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Name of program: **Bachelor of Technology**	
Branch: **Mechanical Engineering**	Semester: **VIII**
Subject: **Robotics (Lab)**	Code: **D037821(037)**
Total Lab Periods: **24**	Batch Size – **30**
Maximum Marks**: 40**	Minimum Marks: **20**

Course Objectives: The main objective of the course is to further enhance the students understanding of concepts of robotics through exposure to suitably designed experiments in robotics laboratory.

List of Experiments: (At least Ten experiments are to be performed by each student)	
1.	Demonstration of Cartesian/cylindrical/spherical robot.
2.	Demonstration of Articulated/SCARA robot.
3.	Virtual modeling for kinematics and dynamic verification any one robotic structure using suitable software.
4.	Design, modeling and analysis of two different types of grippers.
5.	Study of sensor integration.
6.	Two program for linear and non-linear path.
7.	Study of robotic system design.
8.	Programming for forward kinematics problems.
9.	Dynamic analysis of manipulators using software.
10.	Study and demonstration of actuators and vision system.
11.	Study of various robotic applications.
12.	Setting robot for any one industrial application after industrial visit.

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1.	Demonstrate the working of different types of robot
2.	Demonstrate the knowledge of the robotic system design, sensors, actuators, vision systems and robotic application.
3.	Design, model and analyze gripper
4.	Write the program for linear and nonlinear trajectories and forward kinematic problems by using software.
5.	Develop virtual model for kinematic and dynamic verification of robotics structure using software

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Name of program: **Bachelor of Technology**	
Branch: **Mechanical Engineering**	Semester: **VIII**
Subject: **Computer Aided Simulation & Analysis (Lab)**	Code: **D037822(037)**
Total Lab Periods: **24**	Batch Size – **30**
Maximum Marks**: 40**	Minimum Marks: **20**

Course Objectives:
The objective of this course is to expose the students to the modern software for simulation and analysis for various applications in the field of mechanical engineering.

Minimum eight assignments are to be completed on following area using appropriate commercial simulation and analysis software.

1. Structural Analysis
2. Thermal Analysis
3. Fluid Flow Analysis
4. Coupled Field Analysis
5. Modal Analysis.

Course Outcomes:	
On successful completion of the course, the student will be able to:	
1.	Model and analyze structural problem using commercial simulation and analysis software.
2.	Model and analyze Thermal problem using commercial simulation and analysis software.
3.	Model and analyze Fluid Flow problem using commercial simulation and analysis software.
4.	Analyze Coupled field problems using commercial simulation and analysis software.
5.	Determine the natural frequency of an object using commercial simulation and analysis software.