VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
Ibrahimbagh, Hyderabad-31

Approved by A.I.C.T.E., New Delhi and
Affiliated to Osmania University, Hyderabad-07

Sponsored by
VASAVI ACADEMY OF EDUCATION
Hyderabad

SYLLABI UNDER CBCS FOR
B.E VII & VIII SEMESTERS OF MECHANICAL ENGINEERING
(R-23)
WITH EFFECT FROM 2026-27
(For the students admitted in 2023-24)

DEPARTMENT OF MECHANICAL ENGINEERING

+91-40-23146060, 23146061
Fax: +91-40-23146090
Website: www.vce.ac.in

VISION OF THE INSTITUTE

Striving for a symbiosis of technological excellence and human values.

MISSION OF THE INSTITUTE

To arm young brains with competitive technology and nurture holistic development of the individuals for a better tomorrow.

VISION OF THE DEPARTMENT

To establish global leadership in the field of mechanical engineering and develop competent human resources with values and ethics

MISSION OF THE DEPARTMENT

To nurture an environment of research, innovation and knowledge through the latest teaching-learning practices in mechanical engineering

PROGRAM OUTCOMES (POs)	
1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6	Analyse and evaluate societal and environmental aspects while solving complex engineering problems, considering their impact on sustainability with reference to economy, health, safety, legal frameworks, culture, and the environment.
7	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
8	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
9	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
10	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
11	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The mechanical engineering graduates will

PEO1 possess the required foundation and knowledge in the field of mechanical engineering.

PEO2 advance professionally as a result of their ability to solve technical problems and work in multidisciplinary teams leading to significant contribution to the industry

PEO3 acquire life long learning through training programs and higher qualifications.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1 Apply principles of basic sciences and engineering to mechanical systems

PSO2 Model, analyze, design, and realize mechanical components and processes

PSO3 Be prepared to work professionally and ethically in thermal, design and manufacturing areas of mechanical engineering

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
SCHEME OF INSTRUCTION AND EXAMINATION (R-23)
B.E. – MECH : SEVENTH SEMESTER (2026-2027)

B.E (MECH) VII Semester								
Course Code	Name of the Course	Scheme of Instruction			Scheme of Examination			
		Hours per Week			Duration in Hrs	Maximum Marks		Credits
		L	T	D/P		SEE	CIE	
THEORY								
U23PC710ME	Finite Element Method	3	-	-	3	60	40	3
U23PE720ME	Production Drawing	1	-	2	3	60	40	2
U23PC730ME	Industrial Engineering	3	-	-	3	60	40	3
U23PC740ME	Refrigeration and Air Conditioning	3	-	-	3	60	40	3
U23PE7XXME	Professional Elective – I	3	-	-	3	60	40	3
U23PE7XXME	Professional Elective – II	3	-	-	3	60	40	3
U23PEXXXME	NPTEL Course Certification	-	-	-	-	-	-	2
PRACTICALS								
U23PC711ME	Computer Aided Engineering Lab	-	-	2	3	50	30	1
U23PE7XXME	Professional Elective – I	-	-	2	3	50	30	1
U23PE7XXME	Professional Elective – II	-	-	2	3	50	30	1
U23PW719ME	Project Seminar	-	-	2	-	-	30	1
	TOTAL	**16**	**-**	**10**	**-**	**510**	**360**	**23**
	GRAND TOTAL	**26**				**870**		**23**

Left over hours allotted to Sports / Library / PDC / Mentor Interaction / CC / RC / TC / CCA / ECA

		Design Engineering		Thermal Engineering	
		Course Code	**Title**	**Course Code**	**Title**
VII Sem	**PE-I**	U23PE710ME	Robotics Engineering	U23PE720ME	Thermal Turbo Machines
	PE-II	U23PE730ME	Unmanned Arial Vehicles	U23PE740ME	Computational Fluid Dynamics
	PE I Lab	U23PE711ME	Robotics Engineering Lab	U23PE721ME	Thermal Engineering Lab
	PE II Lab	U23PE731ME	Unmanned Arial Vehicles Lab	U23PE741ME	Computational Fluid Dynamics Lab

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

FINITE ELEMENT METHOD

SYLLABUS FOR B.E. VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks : 60	Course Code : U23PC710ME
Credits : 3	CIE Marks: 40	Duration of SEE : 3 Hours

COURSE OBJECTIVES *The objective of this course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
understand the concept of FEA and apply it to 1-dimensional and 2-dimensional problems of structural analysis and 1-dimensional problems of thermal analysis.	1. understand the shape functions and formulate the finite element equations for 1-D elements. 2. evaluate the deflections, stresses and strains for trusses and beams. 3. analyze two dimensional problems for their deflections, stresses and strains. 4. understand the principles used in FE software tools and analyse one dimensional steady state heat transfer problems. 5. formulate the eigen value problem of dynamic systems and obtain the eigen values and eigen vectors for a stepped bar and a beam.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	3	2	3							2	3	1
CO2	1	3	3	1	3							3	2	2
CO3	2	2	2	2	3							2	3	1
CO4	1	3	3	2	2							3	2	2
CO5	2	2	3	1	3							2	3	1

UNIT-I : Analysis of one-dimensional bar element

Introduction to Finite Element Analysis, Steps involved in FEA.

Methods of Finite Element formulations Potential Energy approach, assembly of Global stiffness matrix and load vector, Finite element equations for one dimensional linear bar element, one dimensional problems involving homogeneous boundary condition and point loading.

UNIT-II : Analysis of trusses and beams:
Element stiffness matrix for a plane truss member. Analysis of plane trusses, element stiffness matrix for a 2D-beam member (one rotation and one translation at each node), analysis of 2D beams using point load and UDL.

UNIT-III: Two dimensional problems:
Element stiffness matrix for constant strain triangle element (CST), two dimensional stress analysis using CST elements subjected to point load and uniformly distributed load.
Applications of AI for finite element modeling.

UNIT-IV
Steady state one dimensional conduction heat transfer analysis of composite wall.
Numerical integration using Gaussian Quadrature with two and three point formulae for one dimensional problem.

Type of elements and their degrees of freedom, convergence requirements.
Introduction to Finite Element Analysis software.

UNIT-V
Dynamic Analysis: Formulation of finite element model, significance of eigen vectors, lumped and consistent mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar and a beam.

Learning Resources:
1. Tirupathi R, Chandraputla and Ashok D Belagundu, "Introduction to finite elements in engineering", Prentice Hall of India, 1997.
2. G.Ramamurthy, "Applied Finite Element Analysis", I.K. International Publishing House Pvt. Ltd., New Delhi. 2009.
3. Rao S S, "The Finite Element Method in Engineering", Pergamon Press, 1989.
4. Segerlind L J, "Applied Finite Element Analysis", Wiley Eastern, 1984
5. Reddy J N, "An Introduction to Finite Element Method", McGraw– Hill, 1984

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max.Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

PRODUCTION DRAWING

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 1:0:2	SEE Marks: 60	Course Code: U23PC720ME
Credits : 2	CIE Marks: 40	Duration of SEE: 3Hours

COURSE OBJECTIVES *The objective of this course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
practice the conventional representation of machine elements; limits, fits and tolerances; surface finish and surface treatments; make production drawings and process sheets for a given assembly.	1 revise the fundamentals of drawing, materials and symbols to implement them later in Production drawings. 2 understand limits, fits and tolerances to indicate them on drawings to get suitable fits after assembly. 3 understand the need for surface roughness between surfaces in contact to select suitable mfg process. 4 prepare the process sheet for various components to show the sequence of mfg processes, machines to be used with work holding details. 5 prepare production drawings for parts of various assemblies indicating all conventions required for manufacturing.

UNIT-I: **INTRODUCTION**

Need for production drawing, drawing sheet layout, title block, code designation of steels, copper and Aluminum alloys, Conventional representation of materials and machine components, welding symbols, hydraulic and pneumatic symbols, drafting abbreviations and surface treatment symbols.

UNIT-II: **LIMITS, TOLERANCES AND FITS**

Limit systems, Tolerances, Fits, Tolerances of form and position- and their indication on a drawing, material condition (MMC and LMC), Geometrical tolerancing for MMC.

UNIT-III: **SURFACE ROUGHNESS**

Surface Roughness, surface roughness number, surface roughness expected from manufacturing processes, indication of surface roughness, special surface roughness characteristics, direction of lay, indication of surface roughness symbols on drawings.

UNIT-IV: PROCESS SHEET

Process sheet, its details and uses, process sheet for various machine components like tenon, bearing brass, slip bush, helical gear, flange, main spindle etc.

UNIT-V: PRODUCTION DRAWING

Production drawings from assembly drawings indicating conventions of flange coupling, Universal coupling, foot-step bearing, eccentric, stuffing box, hydraulic cylinder, petrol engine connecting rod, cross head, piston and screw jack.

N.B.: Tolerance charts to be provided in the examination hall for calculation of limits.

Learning Resources:

1. K.L. Narayana, P. Kannaiah and K. Venkata Reddy, "Production Drawing", New Age International Pvt. Ltd., Revised Ed. 1997.
2. T. Narasimha Reddy, T. A. Janardhan Reddy and C. Srinivasa Rao, "Production Drawing Practice", Hitech Publishers, 2001.
3. R.K. Jain, "Engineering Metrology", Khanna Publishers, 2009.

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

INDUSTRIAL ENGINEERING

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks: 60	Course Code: U23PC730ME
Credits : 3	CIE Marks: 40	Duration of SEE: 3Hours

COURSE OBJECTIVES *The objective of this course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
The objectives of this course are to: study work environment, cost analysis, mathematical models to practical problems, inventory control and project management.	1. cost estimation and best suitable person for the given job. 2. Formation of mathematical model to solve practical problems 3. determine the optimal maintenance of inventory to minimise the total cost using different inventory models. 4. construct network models to estimate the project completion time using PERT and CPM techniques.

Unit-I

Work Study: Definition of work study and method study, objectives of method study, method study procedure, various charts for recording. Definition of work measurement, objectives, procedure, stop watch time study, work sampling, standard time calculations, Principles of motion economy.

Unit-II

Job evaluation Definition, objectives various methods of job evaluation, merit rating definition, objectives and various methods of rating, Elements of Cost, overheads, determination of selling price of a product, Ladder of cost. Break even analysis, Depreciation, causes of depreciation, methods of depreciation.

Unit-III

LPP: Formation of LPP, solution to LPP graphical and simplex method, big M method, special cases in LPP, Transportation and assignment models.

Unit-IV

Inventory Control: Importance of inventory control, types of inventory models, inventory costs deterministic inventory models – basic EOQ model derivation, production model without shortages, purchase model with instantaneous replenishment and with shortages, production model with shortages, inventory model with price breaks, ABC and VED analysis, problems on ABC analysis.

Role of AI in the optimization of inventory – a case study.

Unit-V

Project Management: Network fundamentals, differences between PERT and CPM, scheduling the activities, Fulkerson's rule, Earliest and Latest times, determination of ES and EF in forward path, LS & LF in backward path, determination of critical path, Free float, independent float, Total float, program evaluation and review technique.

Learning Resources:

1. Joseph Monk," Operations Management", TMH Publishers, New Delhi, 2004
2. Buffa Elwood S," Modern Production / Operations Management", John Wiley Publishers, Singapore, 2002
3. Everett, E. Adam. Jr and Ronald. J. Ebert, "Production and operations management: concepts, models and behaviour" Prentice Hall of India Pvt. Ltd., New Delhi, 5th ed. 1998.
4. S.D. Sharma, "Operations Research", Kedarnnath, Ramnath & Co., Meerut, 2009.
5. R.M.Barnes: An introduction to method study and work measurement.

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

REFRIGERATION AND AIR CONDITIONING

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: U23PC740ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVE *The objective of the course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
dwell into the basic principles of Refrigeration and Air Conditioning together with their Engineering Applications. discuss basics of refrigeration and describe the working of different types of refrigeration systems; explain the principles of psychrometry, list different equipment used in air conditioning plant.	1. classify the refrigerants and analyze the performance of air refrigeration. 2. analyze the Vapor Compression Refrigeration System and the effects of operating conditions on the system solve problems in vapour compression refrigeration systems and evaluate their performance. 3. explain the working principles of VAR and SJR systems, compare VAR and VCR systems and explain working principles of various refrigeration systems. 4. define different properties of psychrometry. 5. compute sensible and latent heat loads and cooling loads of an air conditioning building and explain working of different Air Conditioning Systems and explain the working principles of typical Air Conditioning Systems

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	3	2	3					1		1	1	2	3
CO2	2	3	2	3					1		1	1	2	2
CO3	2	3	3	2					1		1	1	2	2
CO4	2	3	3	2					1		1	1	2	2
CO5	2	3	3	2					1		1	2	1	1

UNIT-I

Introduction to Refrigeration: Definition of Refrigeration and Air–conditioning –Necessity of Refrigeration and its applications – Methods of Refrigeration, unit of Refrigeration and COP. Reversed Carnot cycle – limitations.

Refrigerants: Classification, Nomenclature and Desirable properties.

Air refrigeration System: Analysis of Bell Coleman cycle/reversed Brayton cycle, open and dense air system.

UNIT-II: Vapour Compression Refrigeration System

Working principle and essential components of a simple vapour compression refrigeration cycle. Analysis of the cycle, COP, Representation of the cycle on T-s,P-h planes. Dry and Wet compression, effect of operating conditions like evaporator pressure, condenser pressure, liquid sub cooling and vapour super heating on performance of the system.

UNIT-III

Vapour Absorption Refrigeration System: Simple absorption system, COP, practical Ammonia absorption refrigeration system, Lithium Bromide absorption system, common refrigerants and absorbents properties.

Working principle of Steam Jet Refrigeration System.

UNIT-IV

Psychrometry: Definition, properties, Psychrometric chart, Psychrometric processes: Sensible cooling and heating, absolute humidification and dehumidification, cooling with dehumidification, heating with humidification, adiabatic humidification and adiabatic chemical dehumidification, mixing processes; Types and working of psychrometers.

Introduction to Air conditioning: Requirements of comfort air conditioning, Thermodynamics of human body.

UNIT-V

Cooling load calculations:

Sensible heat loads, latent heat loads.

Design of Air conditioning system: All fresh air load, Re-circulated air, Concept of by-pass factor, sensible heat factor, Apparatus Dew Point, Room Sensible Heat Factor (RSHF), Gross Sensible Heat Factor (GSHF).

Air conditioning systems: Working of Window/Split air conditioner, packaged air conditioner and central air conditioning system.

Note: Use of R&AC tables and charts permitted in the examination hall.

Learning Resources:

1. Stocker W.F. and A.L. Jones "Refrigeration & Air Conditioning", 2nd Edition, Tata McGraw-Hill, New Delhi, 1985.
2. Roy J.Dossat., "Principles of Refrigeration-SI Version", 4th Edition, Wiley Eastern Limited, New Delhi, 2016.
3. Arora C.P., "Refrigeration and Air Conditioning", 3rd Edition, Tata Mc Graw-Hill, New Delhi, 2010.
4. Arora S.C. and Domkundwar S, "A course in refrigeration and air conditioning," 8th Edition, Dhanpat Rai & Co, 2010.
5. Manohar Prasad., "Refrigeration and Air conditioning", 3rd Edition, New Age International publishers, New Delhi, 2016.
6. Prof Ramgopal, IIT Kharagpur, Web and Video material of NPTEL.

Data Book:

Dr.S.S.Banwait & Dr.S.C.Laroiya., "Birla's Properties of Refrigerant &Psychrometric Tables & Charts in S.I. Units".

The break-up of CIE: Internal Tests+Assignments + Quizzes

1	No. of Internal Tests:	02	Max.Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

ROBOTICS ENGINEERING (PE-I)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks: 60	Course Code: U23PE710ME
Credits : 3	CIE Marks: 40	Duration of SEE: 3Hours

COURSE OBJECTIVE *The objective of the course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
study robot anatomy, configuration, sensors, drives and applications of robots; forward & inverse kinematics, dynamics and control.	1 explain basic terminology of robotics and summarize various industrial applications and specifications of robots. 2 apply direct and inverse kinematics to different robot manipulators using principles of D-H transformation. 3 utilize Jacobian matrix for velocity relationship of joints and end effector and plan trajectory of robots using different techniques. 4 estimate robot dynamics using Lagrange and Newton-Euler methods and develop control laws. 5 outline different types of end effectors, sensors and drives that are needed for effective working of robots.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3					2						2		2
CO2	3	3			2					1		3	1	2
CO3	3	3			2							3	1	2
CO4	3	3			2					1		3	3	1
CO5	3					2						2	1	2

UNIT-I

Laws of robotics, Types of configurations, Degrees of freedom, work envelope, motion control methods. Applications in industry – material handling, loading & unloading, processing, welding & painting applications, assembly and inspection, Robot specification requirements.

UNIT-II

Rotation matrix. Euler angles. RPY representation, Homogeneous transformation matrix. Denavit – Hartenberg convention. Direct and inverse kinematics for industrial robots for position and orientation.

UNIT-III

Manipulator Jacobian. Joint–End effector velocity, Direct and inverse velocity analysis, Trajectory planning, Static force analysis Singularities.

UNIT-IV

Robot dynamics: Lagrangian and Newton–Euler formulation for RR & RP manipulators.

UNIT-V

End effectors: classification and working principle.
Sensors: Position, velocity, vision, proximity and range, tactile and force.
Drives for robots: Electrical, hydraulic and pneumatic.

Learning Resources:

1. M.W. Spong and M. Vidyasagar, "Robot Dynamics and Control", 1st Edition, John Wiley and sons, 1990.
2. R.K.Mittal and I.J. Nagrath, "Robotics and Control", Tata McGraw-Hill, 2003.
3. Mikell P. Groover, Mitchell Weiss, Roger N. Nagel and Nicholas G. Odrey, "Industrial Robotics: Technology, Programming and Applications", McGraw-Hill Companies, 1986.
4. H. Asada and J-J.E. Slotine, "Robot Analysis and Control", Wiley Interscience, 1986.
5. K.S. Fu,R.C. Gonzalez and C.S.G. Lee , "Robotics, Control Sensing Vision and Intelligence", McGraw Hill, Int. Ed. 1987.
6. Siciliano, Bruno, Lorenzo Sciavicco, Luigi Villani, and Giuseppe Oriolo. Robotics: modelling, planning and control. Springer Science & Business Media, 2010.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max.Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

THERMAL TURBO MACHINES (PE-I)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks: 60	Course Code: U23PE720ME
Credits : 3	CIE Marks: 40	Duration of SEE: 3 Hours

COURSE OBJECTIVE *The objective of the course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
Understand basics of compressible flows, study basic principles, governing equations and analysis of flow through turbo machines, jet and rocket propulsion systems.	1 evaluate the basic properties of compressible flow. 2 analyze the performance of centrifugal and axial flow compressors. 3 explain the working principle of steam turbines and analyze their performance. 4 estimate the performance of various gas turbine cycles. 5 illustrate the working of jet and rocket propulsion systems.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	1	1	1						1	3	2	2
CO2	3	2	2	2	1						1	3	2	2
CO3	3	2	2	2	1						1	3	2	2
CO4	3	2	2	2	1						1	3	2	2
CO5	3	2	1	2	1						1	3	2	2

UNIT-I: COMPRESSIBLE FLOWS

Speed of pressure waves, Mach number, acoustic velocity, Mach cone and Mach angle; static and stagnation properties; Stagnation enthalpy, stagnation temperature, stagnation pressure, stagnation velocity of sound and stagnation density, aerofoil nomenclature, lift and drag.

UNIT-II: ROTO DYNAMIC COMPRESSORS

Classification, Centrifugal compressors: principle of operation, Euler Equation, velocity triangles, pre-whirl, slip factor work done. Axial flow compressors: working principle, velocity triangles, Work done factor, stage efficiency, degree of reaction, chocking, surging and stalling.

UNIT-III: STEAM TURBINES

Classification; Impulse turbine - nozzle efficiency, blade efficiency, gross and stage efficiencies; velocity triangles, optimum blade speed ratio, maximum work done and blade efficiency; Compounding of steam turbines.
Reaction turbine- velocity triangles, degree of reaction, blade efficiency, maximum work done.

UNIT-IV: GAS TURBINES

Classification and applications; constant pressure gas turbines, Joule cycle-configuration diagram and T-s diagram, thermal efficiency, maximum pressure ratio, optimum pressure ratio for maximum work done, inter-cooling, reheating and regeneration.

UNIT-V: JET AND ROCKET PROPULSION

Jet engine types and applications, air craft propulsion theory, thrust, thrust power and propulsive efficiency; Turbo jet, Turbo prop, Turbo fan engines, Ramjet engines, pulse jet engines, thrust augmentation;
Rocket Propulsion: types of propellants and working of Rocket engines, Rocket propulsion theory and applications.

Role of AI in Jet and Rocket Propulsion – case study.

Learning Resources:

1. Yahya S.M. "Fundamentals of compressible flow", New Age International publishers, January 2016.
2. Yadav R. "Steam and Gas Turbines and Power plant Engineering", Central Publishing House Ltd, Allahabad.
3. Rajput R.K. "Thermal engineering", Laxmi publications Pvt. Ltd.," 10th edition
4. Ganesan, V., "Gas Turbines", Tata McGraw Hill Book Company, New Delhi.
5. Cohen H Rogers and G.F.C. and H.I.H. Saravanamuttoo, "Gas Turbine Theory", Longman, 5th Edition, New York.

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

UNMANNED AERIAL VEHICLES (PE-II)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks: 60	Course Code: U23PE730ME
Credits : 3	CIE Marks: 40	Duration of SEE: 3Hours

COURSE OBJECTIVES *The objective of this course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
understand the features, basics of flight, design, manufacturing and analysis of UAV and Artificial Intelligence in UAV systems.	1. classify various types of UAVs, describe their characteristics, and analyze their applications. 2. illustrate, explain and interpret the fundamental concepts of aerodynamics relevant to flight vehicles. 3. design, fabricate, and evaluate UAV components using appropriate tools and techniques. 4. perform structural and aerodynamic analysis of UAV components. 5. identify, explain, and evaluate the role of Artificial Intelligence in UAV systems for autonomous operations.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2				3	3				3	3	2	3
CO2	3	3				3	2				3	3	2	3
CO3	3	2				3	2				3	3	2	3
CO4	3	2				3	2				3	3	2	3
CO5	3	2				3	2				3	3	2	3

UNIT-I

Introduction to UAV:

UAV: Definition, History; Difference between aircraft and UAV; DGCA Classification of UAVs; Types and Characteristics of Drones: Fixed, Multi-rotor, and Flapping Wing; Applications: Defense, Civil, Environmental monitoring.

UNIT-II

Basics of Flight:

Different types of flight vehicles; Components and functions of an airplane; Forces acting on Airplane; Physical properties and structure of the atmosphere; Aerodynamics – aerofoil nomenclature, aerofoil characteristics, Angle of attack, Mach number, Lift and Drag, Propulsion and airplane structures.

UNIT-III

UAV Design and Manufacturing:

Airfoil selection, wing design, fuselage design, empennage design, power plant selection, ground control unit, Drone Manufacturing, Additive Manufacturing, Health Evaluation and Failsafe.

UNIT-IV

Structural and Aerodynamic analysis: Introduction to CAD; design of UAV components; structural analysis using CAE; aerodynamic testing of UAV, CFD analysis, fixed wing and multirotor aerodynamic interaction and investigation.

UNIT-V

Artificial Intelligence in UAV Systems:

Components: Arms, motors, propellers, electronic speed controller (ESC), Flight controller; Propulsion; Data Link; Sensors and Payloads: GPS, IMU, Light Detection and Ranging (LiDAR), Imaging cameras, Classification of payload based on applications; Hyper-spectral sensors; Laser Detection and Range (LADAR); Synthetic Aperture Radar (SAR); Thermal cameras; ultra-sonic detectors; Introduction to navigation systems and types of guidance; Mission Planning and Control.

Learning Resources:

1. Handbook of unmanned aerial vehicles, K Valavanis; George J Vachtsevanos, New York, Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.
2. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal
3. DGCA RPAS Guidance Manual, Revision 3 – 2020

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

COMPUTATIONAL FLUID DYNAMICS (PE-II)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks: 60	Course Code: U23PE740ME
Credits : 3	CIE Marks: 40	Duration of SEE: 3Hours

Course objectives	Course Outcomes
The objectives of this course are to: 1. equip the students with the necessary governing equations to use computational techniques to solve problems related to fluid flow and heat transfer. 2. provide the essential numerical background for solving the partial differential equations governing the fluid flow and heat transfer	After completing the course, the student will be able to: 1. familiarize with the differential equations for fluid flow & heat transfer and apply numerical methods for their solution 2. find solution of partial differential equations to estimate the behaviour of the flow phenomena. 3. develop flow simulation code for heat transfer and fluid flow applications using FDM and FVM. 4. make use of different iterative methods to solve algebraic equations for Heat transfer and fluid flows 5. apply suitable grid generation methods to decompose the fluid /solid domain for obtaining the numerical solution

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2	2	2	1						1	2	1
CO2	3	2	2	2	2	1						1	2	1
CO3	3	2	2	2	2	1						1	2	1
CO4	3	2	2	2	2	1						1	2	1
CO5	3	1	2	2	2	1						1	2	1

UNIT-I

Introduction to Computational Fluid Dynamics, CFD applications, comparison amongst Numerical, Analytical and Experimental approaches.

Review of the basic fluid dynamics: Continuity, Navier Stokes equations, Heat conduction equation, steady convection– diffusion equation.

UNIT-II

Classification of partial differential equations – Elliptic, parabolic and hyperbolic equations. Practical examples of elliptic, parabolic and hyperbolic partial differential equations, Well posed problem; Initial and boundary value problems.

Turbulence - Introduction, Mixing length model, RNS equation, K-epsilon turbulence model.

UNIT-III

Concepts of Finite difference methods - forward, backward and central difference. Finite difference solution - 1-D steady state heat conduction parabolic partial differential equations - Euler, Implicit method, Crank - Nicolson method.

Errors, Consistency, Stability analysis, Convergence criteria

UNIT-IV

Solution of System of Linear Algebraic Equations: Tridiagonal matrix algorithm (TDMA): Iteration methods: Jacobi and Gauss-Seidel.

Viscous incompressible flow, stream function - Vorticity method.

Introduction to grid generation - Types of grid - Structured and Unstructured grids.

UNIT-V

Introduction to finite volume method: Finite volume formulations for diffusion equation, 1-D steady state heat conduction.

Convection diffusion equation: Central difference scheme, Upwind scheme, Staggered grid, SIMPLE Algorithm.

Learning Resources:

1. John D Anderson, "Computational Fluid Dynamics", Mc Graw Hill Inc., New York, 2003.
2. Patankar S V, "Numerical Heat Transfer and Fluid Flow", Hemisphere Publishing Company, New York 1980.
3. H.K. Versteeg, W. Malalasekara, "An Introduction to computational Fluid Dynamics", 2nd Ed., Pearson Education, 2007.
4. Chung T J, "Computational Fluid Dynamics", Cambridge University Press, New York, 2002
5. Muralidhar K, Sundararajan T, "Computational Fluid Flow and Heat Transfer", Narosa publication House, New Delhi, 2003.

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

COMPUTER AIDED ENGINEERING LAB

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P (Hrs/week): 0:0:2	SEE Marks: 50	Course Code: U23PC711ME
Credits : 1	CIE Marks: 30	Duration of SEE: 3Hours

COURSE OBJECTIVE *The objective of the course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
understand the CAE software applicability for analyzing structural and thermal problems and correlate mathematical formulation using FE method.	1. select appropriate finite element and solve1-D, 2-D and 3-Dstatic structural problems. 2. Perform Modal, Harmonic and Transient analysis on beams. 3. select appropriate finite element and solve 1-D,2-D thermal problems. 4. understand the importing of complex models from modelling software and perform analysis using FE software.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	1	2	2	3	2							2	2	3
CO2	2	3	2	3	3							2	3	2
CO3	1	2	3	3	2							1	2	3
CO4	1	2	2	3	3							2	3	2

List of Experiments

1. Analysis using 1-d bar elements.
2. Analysis of Trusses
3. Analysis of Beams with different boundary conditions
4. Analysis of Beams with different loading conditions
5. Analysis of Plane stress and Plane strain problems
6. Analysis of axi-symmetric problems
7. Analysis of three dimensional objects by modeling them in FEA software

8. Modal Analysis of Beams.
9. Harmonic Analysis of Beams
10. Transient Analysis of Beams
11. Steady state Heat Transfer Analysis of a composite wall
12. Developing a 3-D Model in a modeling software and analyzing it by importing into FEA software
13. Buckling analysis of columns.
14. Dynamic analysis of mechanisms

From the above experiments, each student should perform at least 12 (Twelve) experiments.

No. of Internal Tests:	02	Max. Marks for Internal Tests:	12
Marks for day-to-day laboratory class work			18
Duration of Internal Test: 2 Hours			

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

ROBOTICS ENGINEERING LAB (PE-I Lab)

SYLLABUS FOR B.E. VII-SEMESTER

Instruction : 2 Hours /week	SEE Marks : 50	Course Code : U23PE711ME
Credits : 1	CIE Marks : 30	Duration of SEE: 2 Hours

COURSE OBJECTIVE The objective of the course is to	**COURSE OUTCOMES** On completion of the course, students will be able to
model, analyses different types of industrial robotics using CAD software and 6DOF serial manipulator.	1. Modelling of various industrial robotics using ADAMS software. 2. Designing and controlling of robotic path using various sensors. 3. Analyses of forward and inverse kinematics of industrial manipulator using 6-dof serial manipulator

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	1	3		1	3						2	1	3	2
CO2	1		3	1	3						2	1	3	2
CO3	1	3		1	3						2	1	3	2

List of Experiments:

1. Formulation of DH matrix for 6-DOF U-factory lite manipulator.
2. Modeling of 6-DOF U-factory lite manipulator using CAD software.
3. Simulation of 6-DOF U-factory lite manipulator using CAD software.
4. Forward kinematic analysis of 4-DOF SCARA configuration using MATLAB.
5. Inverse kinematic analysis of 4-DOF SCARA configuration using MATLAB.
6. Modeling and simulation of 2-Link manipulator using Simscape.
7. Assembling of robot mechanical components mounting of motors, sensors, electronic circuits to the chassis.
8. Navigation and obstacle avoidance robot using ultrasonic sensor.
9. Programming and controlling a line follower Infrared Sensor.
10. Programming and controlling of mobile robot using Raspberry Pi.

11. Modeling and simulation of industry manipulator using CoppeliaSim.
12. Assembling of drone using mechanical components mounting of motors, sensors, electronic circuits
13. Forward kinematic analysis of 6-DOF Parallel manipulator
14. Inverse kinematic analysis of 6-DOF parallel manipulator

The break-up of CIE: Internal Tests + Assignments + Quizzes

No. of Internal Tests:	02	Max. Marks for Internal Test:	12
Marks for day-to-day laboratory class work			18
Duration of Internal Test: 3Hours			

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

THERMAL ENGINEERING LAB (PE-I Lab)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 0:0:2	SEE Marks: 50	Course Code: U23PE711ME
Credits : 1	CIE Marks: 30	Duration of SEE: 3 Hours

COURSE OBJECTIVE *The objective of the course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
apply basic laws of thermodynamics and heat transfer to thermal systems, principles of turbomachinery to fluid systems.	1 study the various modes of heat transfer using heat transfer equipment. 2 determine the COP of air conditioning/refrigeration system. 3 study the pressure distribution on various aerodynamic models and calculate lift and drag coefficients using low speed wind tunnel. 4 evaluate the performance of thermal turbomachines (centrifugal blower and axial fan).

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	3	1					2		1	3	1	2
CO2	3	2	3	1					2		1	3	1	2
CO3	3	2	3	1					2		1	3	1	2
CO4	3	2	3	1					2		1	3	1	2

List of Experiments

1. Determination of thermal conductivity of insulating material using Lagged pipe apparatus.
2. Determination of heat transfer coefficient under natural convection
3. Determination of pin–fin efficiency subjected to natural and forced convection.
4. Determination of effectiveness of parallel flow and counter flow heat exchanger.
5. Determination of emissivity of a plate.
6. Determination of Stefan - Boltzmann constant.
7. Determination of COP of the Refrigeration systems using capillary tube.

8. Pressure distribution on symmetrical and unsymmetrical specimen in wind tunnel.
9. Measurement of lift and drag forces of the model in wind tunnel.
10. To study of performance characteristics curves of a centrifugal blower.
11. To study of performance characteristic curves of an axial flow fan.
12. Determination of CoP of air conditioning test rig.
13. Study the gas turbine model.

The break-up of CIE: Internal Tests + Assignments + Quizzes

No. of Internal Tests:	02	Max. Marks for Internal Tests:	12
Marks for day-to-day laboratory class work			18
Duration of Internal Test: 2 Hours			

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

UNMANNED AERIAL VEHICLES LAB (PE-II Lab)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 0:0:2	SEE Marks: 50	Course Code: U23PE731ME
Credits : 1	CIE Marks: 30	Duration of SEE: 3 Hours

COURSE OBJECTIVES *The objective of this course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
experimentally and computationally analyze aerodynamic forces and form drag on UAV components under varying flow conditions and geometries using modern design and fabrication tools.	1. analyze the effects of angle of attack and velocity on lift and drag over various airfoil shapes. 2. visualize and interpret form drag behavior across different geometries under varying wind conditions. 3. measure and evaluate pressure distribution on cylindrical and airfoil models at different flow velocities. 4. develop airfoil models using CAD tools and fabricate them using additive manufacturing techniques. 5. conduct experimental investigations to validate aerodynamic performance of 3D-printed UAV airfoil models and interpret results.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	1	3	3	3	3	2	2	1	3	3	2	3
CO2	3	3	1	3	3	3	2	2	2	1	3	3	2	3
CO3	3	2	1	3	3	3	2	2	2	1	3	3	2	3
CO4	3	2	2	3	3	3	2	2	2	1	3	3	2	3
CO5	3	2	1	3	3	3	2	2	2	1	3	3	2	3

List of Experiments

1. To determine the effect of angle of attack and velocity on the lift and drag of uncambered airfoil of fixed wing UAV.
2. To visualise the form drag at various angle of attacks and velocities on uncambered airfoil of fixed wing UAV.
3. To determine the effect of angle of attack and velocity on the lift and drag of cambered airfoil of fixed wing UAV.

4. To visualise the form drag at various angle of attacks and velocities on cambered airfoil of fixed wing UAV.
5. To determine the effect of velocity on the pressure variation on the cylindrical model.
6. To visualise the form drag at various wind velocities on cylindrical model.
7. To determine the effect of angle of attack and velocity on pressure variation on the uncambered airfoil of the fixed wing UAV.
8. To visualise the form drag at various wind velocities on rectangular plate, circular plate and triangular prism.
9. To visualise the form drag at various wind velocities on sphere and hollow hemi sphere.
10. To develop uncambered airfoil model using CAD software (remote laboratory experiment).
11. To fabricate the uncambered airfoil model using additive manufacturing.
12. To determine the effect of angle of attack and velocity on the lift and drag of 3D printed uncambered airfoil of fixed wing UAV.
13. To visualise the form drag at various angle of attacks and velocities on 3D printed uncambered airfoil of fixed wing UAV.
14. To observe the effect of angle of attack and velocity on the lift, drag and form drag of a fixed wing drone model (Demonstration)

The break-up of CIE: Internal Tests + Assignments + Quizzes

No. of Internal Tests:	02	Max. Marks for Internal Tests:	12
Marks for day-to-day laboratory class work			18
Duration of Internal Test: 2Hours			

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

COMPUTATIONAL FLUID DYNAMICS LAB (PE-II Lab)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 0:0:2	SEE Marks:50	Course Code: U23PE741ME
Credits : 1	CIE Marks:30	Duration of SEE: 3 Hours

COURSE OBJECTIVE *The objective of the course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
To study and analyze the internal and external over profiles using commercial software package.	1 understanding modelling and meshing of geometries in computational tools. 2 analyze internal and external flow using various geometries. 3 analyse steady and unsteady flows. 4 analyse fluid flow with heat transfer.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	3	1					2		1	3	1	2
CO2	3	2	3	1					2		1	3	1	2
CO3	3	2	3	1					2		1	3	1	2
CO4	3	2	3	1					2		1	3	1	2

List of Experiments

1. Introduction to computational process and computational software package
2. Modelling and meshing of basic geometries in workbench
3. Develop the numerical solution to a laminar pipe flow.
4. Develop the numerical solution to a turbulent pipe flow.
5. Develop the numerical solution to a flat plate boundary layer.
6. Numerical analysis of compressible flow through a nozzle
7. Numerical analysis of flow over an aerofoil
8. Analysis of flow through pipe under laminar convection
9. Analysis of flow through pipe under turbulent convection
10. Analysis of flow under natural convection.
11. Analysis of shall and tube heat exchanger
12. Steady flow analysis of 3D Bifurcating Artery

No. of Internal Tests:	02	Max. Marks for Internal Tests:	12
Marks for day-to-day laboratory class work			18
Duration of Internal Test: 2Hours			

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

PROJECT SEMINAR

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 0:0:2	SEE Marks:--	Course Code: U23PW719ME
Credits : 1	CIE Marks: 30	Duration of SEE: ---

COURSE OBJECTIVE *The objective of the course is to*	**COURSE OUTCOME** *On completion of the course, students will be able to*
actively involve the students in the initial work required to undertake the final year project.	1. do the literature search to identify the project. 2. define the problem and identify the specifications 3. understand tools and techniques to be used in the project 4. design, manufacturing and analysis of the chosen project.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3										3	1	1	1
CO2		3	2	2	2						2	2	2	3
CO3					3	3					2	3	3	2
CO4	3	3	2	2			3	2	3	2	3	3	1	3

The objective of the project seminar is to actively involve the students in the initial work required to undertake the final year project. It may comprise of:

1. Problem definition and specifications.
2. A broad understanding of the available techniques to solve a problem of interest.
3. Presentation (oral and written) of the project.
4. Submission of brief report.

The Department can initiate the work related to project allotment at the end of III year II semester and complete it in the first two weeks of the fourth year I semester.

First 4 weeks of IV year Ist semester will be spent on special lectures by faculty members, research scholar and speakers from industries and R&D institutions. The objective of these talks is to expose students to real life / practical problems and methodologies to solve them.

A seminar schedule will be prepared by the coordinator for all the students. It should be from the 5th week to the last week of the semester and should be strictly adhered to.

Each student will be required to

1. Submit a one page synopsis of the seminar to be delivered.
2. Give a 20 minute presentation followed by 10 minutes discussion.
3. Submit a technical write up on the talk delivered.

At least two teachers will be associated with the evaluation of the project seminar for the award of the sessional marks which should be on the basis of performance of all the three items stated above.

No. of Presentations	1	Max. Marks for presentation:	30
Marks will be awarded based on synopsis, submission of write-up and presentation using rubrics.			
Duration of Presentation: 20 min			

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)
SCHEME OF INSTRUCTION AND EXAMINATION (R-23)
B.E. – MECH : EIGHTH SEMESTER (2026-2027)

B.E (MECH) VIII Semester								
Course Code	Name of the Course	Scheme of Instruction			Scheme of Examination			
		Hours per Week			Duration in Hrs	Maximum Marks		Credits
		L	T	D/P		SEE	CIE	
THEORY								
U23PE8XXME	Professional Elective-III	3	-	-	3	60	40	3
U23PE8XXME	Professional Elective-IV	3	-	-	3	60	40	3
U23PW819ME	Project / Internship	-	-	12	Viva - Voce	50	50	6
	TOTAL	**6**	**-**	**12**		**170**	**130**	**12**
	GRAND TOTAL	**18**				**300**		**12**

Professional Electives							
		Design engineering		Thermal engineering		Industrial engineering	
		Course Code	Title	Course Code	Title	Course Code	Title
VIII Sem.	PE-III	U23PE810ME	Product Design and Development	U23PE820ME	Renewable Energy Systems	U23PE830ME	Industry 4.O and Automation
	PE-IV	U23PE840ME	Composite Materials	U23PE850ME	Power Plant Engineering	U23PE860ME	Production and Operations Management

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

PRODUCT DESIGN AND DEVELOPMENT (PE-III)

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks: 60	Course Code: U23PE810ME
Credits : 3	CIE Marks: 40	Duration of SEE: 3 Hours

COURSE OBJECTIVE *The objective of the course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
Study product and process design functions, selection and evaluation of projects, new product development, new product planning and product life cycle management.	1 illustrate creativity and study the techniques of innovation 2 assess the evaluation techniques for screening ideas 3 differentiate the IPR-Patents, Design patents, copy right and trade mark and their laws. 4 describe the interaction between design, manufacture, quality, testing and introducing new products. 5 Learn new concepts in product development and life cycle management.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2		1			3	2		1	2		1	2	2
CO2	2		1			3	2		1	2		1	2	2
CO3	2		1			3	2		1	2		1	2	2
CO4	2		1			3	2		1	2		1	2	2
CO5	2		1			3	2		1	2		1	2	2

UNIT-I

Product Design and Process Design functions. Selection of right product. Systematic procedure of product innovation. Factors contributing to successful technological innovation – need for creativity and innovation. Techniques of innovation like brain storming and Delphi techniques.

UNIT-II

Project selection and evaluation: Collection of ideas and purpose of project. Selection criteria – screening ideas for new products using evaluation techniques. Principles of ergonomics, function of design – Design with Human Machine Interaction (HMI).

UNIT-III

New Product Development: Concept testing and market analysis.
Intellectual Property Rights (IPR): Types, definitions, Patents, patent search, patent laws, international code for patents

UNIT-IV

New Product Planning: Design principles, design for manufacturing and assembly, quality control during design, prototyping. Steps for introducing new products after evaluation.

UNIT-V

Value engineering: Types of value, functions, value analysis job plan, value analysis tests, costs reduction through VE.
Product life cycle management: Definition, PLM Life cycle model, elements of PLM, need for PLM, opportunities and benefits of PLM, components and phases of PLM, PLM feasibility study, PLM visioning.

Learning Resources:

1. Karl T. Ulrich, Steven D. Eppinger, Maria C. Yang, Product Design and Development, Mc Graw Hill 2020.
2. Kevin Otto, Kristin Wood, Product Design, Pearson, 2003.
3. Chitale AK & Gupta R.C, Product Design & Manufacturing, – Prentice Hall of India, 1997.
4. Niebel BW & Draper AB, Production Design & Process Engg., Mc Graw Hill Kogakusha, 1974.
5. Harry, B. Waton, New Product Planning, Prentice Hall Inc., 1992.
6. Greaves Michael, Product Life Cycle Management – Driving the next generation of lean thinking, McGraw Hill, 2006, ISBN 0071452303

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests:	02	Max.Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

RENEWABLE ENERGY SYSTEMS (PE-III)

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks: 60	Course Code: U23PE820ME
Credits : 3	CIE Marks: 40	Duration of SEE: 3 Hours

COURSE OBJECTIVES *The objective of this course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
study the availability and applications of various renewable energy systems like solar energy, wind energy, geothermal energy, ocean thermal energy, tidal and wave energy, fuel cell energy and biomass energy.	1 Illustrate the constructional details and working of solar energy conversion devices for various heating and cooling applications. 2 describe the working of different wind and geothermal energy conversion systems used for power generation. 3 Explain the working of ocean thermal, tidal and wave energy power plants for power generation. 4 illustrate the constructional details, working and applications of different fuel cells. 5 discuss the constructional details, working of different types of bio gas plants for domestic cooking and other applications.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2			2	2		2			3	2	1
CO2	3	2	2			2	2		2			3	2	1
CO3	3	2	2			2	2		2			3	2	1
CO4	3	2	2			2	2		2			3	2	1
CO5	3	2	2			2	2		2			3	2	1

UNIT-I

Introduction and classification of Renewable Energy Systems.

Solar Energy: Availability of solar energy, Measurement of sunshine, solar radiation data, estimation of average solar radiation, solar energy selection, selective surfaces, constructional details and working of solar flat plate and evacuated tube collectors, solar heating and cooling; other solar thermal applications. Solar Photo-voltaic cell and its efficiency.

UNIT-II

Wind Energy: Wind mills and wind turbine systems; classification of wind machines: horizontal & vertical axis configuration; High and low solidity rotors, elements of wind mills and wind turbine systems; Site selection to establish wind turbine power plants, Aerodynamic models, Rankine Froud Actuator disc model.

UNIT-III

Geothermal Energy: Earth as source of heat energy; Nature of Geothermal Fields, Geothermal sources. Hydrothermal sources;

Ocean Thermal Energy: Ocean thermal energy sources,

Tidal Energy: Classification and working of Tidal power plants, Limitations of Tidal energy.

Ocean Wave Energy Technology: Classification of wave energy conversion devices.

UNIT-IV

Fuel Cell Energy: Description, classification and operation of fuel cells; major components & general characteristics of fuel cells; working of Alkaline Fuel Cell, Direct Methanol Fuel Cell, Phosphoric Acid Fuel Cell, Solid Oxide Fuel Cell, Proton/Polymer exchange membrane fuel cell and molten carbonate fuel cell systems.

UNIT-V

Bio-mass Energy: conversion techniques for the production of liquid and gaseous fuels by bio-chemical methods - types of feed stock, constructional details and working of fixed dome, flexible bag and floating dome type bio gas plants.

Learning Resources:

1. Twidell J.W. & Weir A., "Renewable Energy Sources", 2nd Edition, EFN Spon Ltd., UK, 1986.
2. G.D. Rai, "Non-Conventional Energy Sources", 4th Edition, Khanna Publishers, New Delhi, 2009.
3. B.H. Khan, "Non-Conventional Energy Sources", Tata McGraw-Hill Education Private Limited, New Delhi.
4. S.Rao, Dr.B.B. Parulekar Energy Technology(Non-conventional, Renewable and Conventional), Khanna Publishers, Delhi.
5. S.Hasan Saeed, D.K. Sharma, "Non –conventional energy Resources", 3rd Edition, S.K. Kataria& Sons, 2012.

Web Resources:

1. www.renewable-energy-sources.com/

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Tests:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

INDUSTRY 4.0 AND AUTOMATION (PE-III)

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks: 60	Course Code: U23PE830ME
Credits : 3	CIE Marks: 40	Duration of SEE: 3 Hours

COURSE OBJECTIVES The objectives of the course is to	**COURSE OUTCOMES** On completion of the course, students will be able to
1. Provide an application-oriented understanding of Industry 4.0 in manufacturing systems. 2. Introduce cyber-physical integration and data-driven decision making. 3. Develop knowledge of industrial automation components and control strategies. 4. Enable analysis of automated production systems and their performance. 5. Familiarize students with modern tools used in smart and automated factories.	1. analyze key technologies of Industry 4.0 and their role in manufacturing systems. 2. evaluate cyber-physical integration and data-driven production processes. 3. understand automation components and their functional relationships. 4. apply control strategies in industrial automation systems. 5. analyze performance of automated manufacturing systems.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	3	2		2						2	2	2	
CO2	3	2	2	3	2						2	2	2	
CO3	3	3	2	2							2	2	2	
CO4	3	3	3	2	3						2	2	2	2
CO5	3	3	3	2	3						2	2	2	2

UNIT-I

Fundamentals of Industry 4.0 and Smart Manufacturing

Evolution of manufacturing systems: conventional automation to smart manufacturing. Overview of Industry 4.0 architecture. Key enabling technologies: IoT, IIoT, Cyber-Physical Systems, Big Data and Cloud Manufacturing. Smart factory concepts: connectivity, interoperability, and data exchange. Digital representation of physical systems (digital twins) and their

role in production. Basic analysis of production data, system throughput and efficiency in connected environments.

UNIT-II

Cyber-Physical Integration and Smart Production Systems

Structure and operation of Cyber-Physical Production Systems (CPPS). Communication and coordination in networked manufacturing systems. Real-time data acquisition and processing. Smart workpieces, RFID and tracking systems. Human-machine interaction and collaborative systems. Introduction to cloud-based manufacturing and distributed production systems. Evaluation of system performance in connected environments and impact of integration on productivity.

UNIT-III

Industrial Automation Components and Systems

Introduction to automation in manufacturing. Types of automation: fixed, programmable and flexible automation. Elements of automated systems: sensors, actuators, controllers and feedback systems. Signal conditioning and interfacing. Basic architecture of PLCs and their operation. Functional analysis of automation systems.

UNIT-IV

Industrial Control Systems for Automation

Control strategies in automation systems. Open-loop and closed-loop control. Basic control actions: on-off, proportional, integral and derivative control. PLC programming fundamentals and ladder logic. Sequential control in automated systems. Introduction to SCADA systems and industrial communication networks.

UNIT-V

Automated Manufacturing Systems and Performance Analysis

Automated production systems: transfer lines and assembly systems. Material handling and storage systems. Automated inspection and quality control. Production system performance measures: cycle time, production rate, utilization and efficiency. Line balancing and system optimization. Introduction to Flexible Manufacturing Systems (FMS) and Computer Integrated Manufacturing (CIM).

Learning Resources:

1. Alasdair Gilchrist, *Industry 4.0: The Industrial Internet of Things*, Apress, 2016.
2. Mikell P. Groover, *Automation, Production Systems, and Computer-Integrated Manufacturing*, Pearson.

3. Bolton, W., *Programmable Logic Controllers*, Elsevier.
4. Krishna Kant, *Computer-Based Industrial Control*, PHI Learning.
5. Serope Kalpakjian & Steven Schmid, *Manufacturing Engineering and Technology*, Pearson.

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	5
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	5

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

COMPOSITE MATERIALS (PE-IV)

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks: 60	Course Code: U23PE840ME
Credits : 3	CIE Marks: 40	Duration of SEE: 3 Hours

COURSE OBJECTIVE *The objective of the course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
understand the basic principles and importance of composite materials and analyse the micro and macro mechanics of composite materials.	1 understand the importance of composite materials in Engineering applications 2 interpret the manufacturing of composites 3 analyse the composites for various elastic constants at macro level and micro level 4 understand the basic theories of failures associated with composites. 5 estimate and Calculate the strength of laminated composites.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	1	1	2						2	3	2	2
CO2	3	2	1	1	2						2	3	2	2
CO3	3	2	1	1	2						2	3	2	2
CO4	3	2	1	1	2						2	3	2	2
CO5	3	2	1	1	2						2	3	2	2

UNIT-I: INTRODUCTION TO COMPOSITES

Classification of Composites. Fiber Types and its properties.
Matrix materials and its properties. Thermoset Matrices, Thermoplastic matrices, Applications of Composite Materials.

UNIT-II: MANUFACTURING OF POLYMER COMPOSITES

Hand– Lay– Up, Spray technique Bag Molding, Autoclave processing, compression Molding, Resin Transfer Molding, Pultrusion, filament winding, tape winding.

UNIT-III: MICROMECHANICS OF COMPOSITES

Volume and Mass fraction, Heterogeneous, Anisotropic, Orthotropic, Transversely lsotropic and Isotropic Materials.
Mechanical Properties: Prediction of Elastic constants, micromechanical approach, Halpin– Tsai equations.

UNIT-IV: MACROMECHANICS OF COMPOSITES

Elastic constants of a lamina, relations between engineering constants and reduced stiffness and compliances, variation of lamina properties with orientation, Classification of Laminated composites, analysis of laminated composites, stresses and strain with orientation.

UNIT-V: STRENGTH OF ORTHOTROPIC LAMINA

Tensile and compressive strength of unidirectional fiber composites, fracture modes in composites, delamination failure, Maximum stress theory, maximum strain theory Tsai– Hill Criterion, Tsai– Wu Criterion.

Learning Resources:

1. Madhujit Mukhopadhyaya, "Mechanics of Composite Materials and Structures", Universities Press, 2004
2. Ronald F.Gibson, "Principles of composite Materials Mechanics", McGraw– Hill Inc, 1994.
3. Krishna, K.Chewla. "Composite materials", Springer– Verlag, 1987.
4. Carl. T.Herakovich, "Mechanics of Fibrous Composites", John Wiley sons inc., 1998
5. Ever J.Barbero, "Introduction to composite Materials Design", Taylor & Francis, 1999.
6. Jones, R.M., "Mechanics of composite Materials", McGraw– Hill Inc. 1967.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

POWER PLANT ENGINEERING (PE-IV)

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks: 60	Course Code: U23PE850ME
Credits : 3	CIE Marks: 40	Duration of SEE: 3 Hours

COURSE OBJECTIVE *The objective of the course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
impart knowledge on various sources of energy, types of power plants, their working and economics of power generation.	1 describe various sources of energy, working of steam power plant and fuel handling equipment. 2 Explain combustion processes, ash handling systems and cooling towers of steam power plant. 3 analyze principles and working of hydro-electric power plant. 4 describe principles and working of nuclear power plant. 5 estimate the cost of power generation and the environmental effects of power plants.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2	2			2	2		2			3	2	1
CO2	3	2	2			2	2		2			3	2	1
CO3	3	2	2			2	2		2			3	2	1
CO4	3	2	2			2	2		2			3	2	1
CO5	3	2	2			2	2		2			3	2	1

UNIT-I

Introduction to sources of Energy: Resources and development of Power in India. Principles of power generation for various conventional and non-conventional power plants.

Steam Power plant: selection of site for a thermal power plant, Plant Layout, Working of different circuits, Types of Coal, Coal Handling, Fuel handling equipment.

UNIT-II

Combustion Process: Overfeed and underfeed fuel beds, Travelling grate stokers, Spreader stokers, Retort stokers, Pulverized fuel burning systems and its components, working principle of Cyclone furnace, Ash Handling Systems, draught system, Dust collectors, Working principle of Cooling Towers.

UNIT-III:

HYDRO ELECTRIC POWER PLANT

Hydroelectric Power Plant:

Water Power, Hydrological Cycle, measurement of run-off, selection of site for a hydroelectric power plant, Essential features of a hydro power plant. Hydrographs, Flow duration curve and mass curve.

UNIT-IV: NUCLEAR POWER PLANT

selection of site for a nuclear power plant, Nuclear fuels, conversion and breeding, fertile materials, methods of enriching uranium, Nuclear Reactors, working of reactors, Pressurized water reactor, Boiling Water Reactor, Sodium Graphite Reactor, Fast Breeder Reactor, Gas cooled Reactor, Radioactive waste disposal.

Role of AI in Nuclear Power Plant – Case Study

UNIT-V

Power plant Economics and Environmental considerations

Capital cost, Investment of fixed charges, Operating costs, General arrangement of power distribution, Load curves, Average Load and Load Factor, Diversity Factor.

Effluents from Power plants and impact on environment

Pollutants and Pollution standards, Methods of Pollution control.

Learning Resources:

1. Rajput, R.K, "A Text Book of Power Plant Engineering', 5TH Edition, Laxmi Publications, New Delhi, 2016.
2. Arora S.C, Domukundwar S, "A Course in Power Plant Engineering", Dhanpat Rai &Sons, New Delhi, 2005
3. P C Sharma, "A Text Book of Power Plant Engineering", S K Kataria & Sons, 2013
4. Nag P.K, "Power Plant Engineering", 2nd Edition, Tata Mc Graw Hills Co. Ltd., New Delhi, 2002.
5. Wakil M.M, "Power Plant Technology", Mc Graw Hill publications, New York, 2005.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max.Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

PRODUCTION AND OPERATIONS MANAGEMENT (PE-IV)

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks: 60	Course Code: U23PE860ME
Credits : 3	CIE Marks: 40	Duration of SEE: 3 Hours

COURSE OBJECTIVES The objectives of this course are to:	**COURSE OUTCOMES** On completion of the course, the student will be able to:
study the types of plant layout, forecasting methods, cost analysis, human resource management quality control.	1. Classify the types of plant layouts, production systems based on product using the facilities of the plant 2. Estimate the future demand using forecasting methods through qualitative and quantitative models 3. Determine the requirement of resources to minimise the total cost using aggregate planning techniques. 4. Selection of right to the right job to suitable pay for the human resources. 5. Importance of quality and checking the process capability.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3	2		1						1	2	3	1	1
CO2	3	2		2						2	2	3	1	1
CO3	3	2		2						2	2	3	2	1
CO4	3	2		3						2	2	3	1	1
CO5	3	2		1						3	2	3	2	2

UNIT-I

Production & Operations Management: Introduction, Types of Production Systems – Job shop, Batch, Flow shop. Types of business organizations and organization structures.

Plant location and layout: Factors affecting plant location, plant layout objectives, types of layouts, merits and demerits.

UNIT-II

Forecasting: Introduction, forecasting objectives and uses, demand patterns, qualitative models – market survey, delphi, quantitative models – moving average, weighted moving average, simple exponential smoothing, trend adjusted exponential smoothing, least square method, simple regression, multiple regression. Forecast Errors: mean absolute deviation (MAD), mean square error (MSE), Mean Forecast Error (MFE), mean absolute percentage Error (MAPE)

UNIT-III

Aggregate planning and master scheduling: Introduction, objectives of aggregate planning, cost in aggregate planning, strategies in aggregate planning, master production scheduling. Materials requirement planning MRP: Importance of MRP, MRP system inputs and outputs, MRP calculations. Calculations of net amount required (units) and planned order releases in BOM structures.

Role of AI in effective utilization of resources - a case study.

UNIT-IV

Human resource management: Concept and objectives, man power planning, recruitment and selection, training and developments, wages and incentives methods. Industrial acts.

UNIT-V

Quality and reliability: Definition of quality, objectives, cost of quality and value of quality. Acceptance sampling, Statical process control, process variability, Control charts for variables and attributes. Definition of reliability bath tub curve and estimation of reliability for different systems

Learning Resources:

1. Joseph Monk," Operations Management", TMH Publishers, New Delhi, 2004
2. Buffa Elwood S," Modern Production / Operations Management", John Wiley Publishers, Singapore, 2002
3. Everett, E. Adam. Jr and Ronald. J. Ebert, "Production and operations management: concepts, models and behaviour" Prentice Hall of India Pvt. Ltd., New Delhi, 5th ed. 1998.
4. Garry Desseler: Human resource management, pearson education.
5. Montgomory " Statistical Process control", PHI.

The break-up of CIE: Internal Tests+ Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	05
3	No. of Quizzes:	03	Max. Marks for each Quiz Test:	05

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

Project /Internship

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 0:0:12	SEE Marks: 50	Course Code: U23PW819ME
Credits : 6	CIE Marks: 50	Duration of SEE: --

COURSE OBJECTIVE *The objective of the course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
solve a real life problem related to Mechanical engineering using relevant tools and techniques, write a thesis and give a presentation.	1. define the problem by literature study. 2. design and conduct experiments using Mechanical Engineering tools to collect data. 3. analyze and interpret data using graphs. 4. make logical conclusions to justify the results.

CO-PO and CO-PSO mapping															
CO	PO mapping												PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3											3	3	3	2
CO2		3	3	2	3							3	3	2	3
CO3					3	3	3	1	1	3		3	1	2	2
CO4	2	1								3	3	3	1	2	3

The department will appoint a project coordinator who will be in-charge of the following.

- Grouping of students (Maximum of 3 in a group)
- Allotment of project guide
- Project progress monitoring at regular intervals
- Attendance monitoring for those students doing project in Industry / Internship.

The project allotment should be completed by the IV week of VII semester so that students get enough time for completion of their project.

All the projects are to be checked for progress at least twice in a semester. CIE marks (50 marks) are based on the performance in the two presentations which are awarded by a committee based on project rubrics.

The SEE marks (50 marks) are awarded by an external examiner based on a viva-voce exam.

Norms of final documentation of the project report will be provided by the Department.

No. of Presentations for CIE marks	2	Max. Marks for each CIE presentation:	25
Marks are awarded based on literature study, technical details, presentation and conclusions using rubrics.			
Duration of Presentation: 20 min			

VASAVI COLLEGE OF ENGINEERING (AUTONOMOUS)

SCHEME OF INSTRUCTION AND EXAMINATION (R-23)

B.E. (ME) Honours Degree Program in Robotics

B.E (ME) Honours Degree in Robotics								
S. No.	Name of the Course	Scheme of Instruction			Scheme of Examination			
		Hours per Week			Duration in Hrs	Maximum Marks		Credits
		L	T	P		SEE	CIE	
THEORY CUM PRACTICALS								
VII-Semester AY 2025-26								
U23PC760ME	Robotics and Control	3	-	-	3	60	40	3
U23PC731ME	Robotics Lab	-	-	2	3	50	30	1
U23PW729ME	Course Project	-	-	6	3	50	50	3
	TOTAL	**3**	**0**	**8**		**160**	**120**	**7**
	GRAND TOTAL	**11**				**280**		**7**

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

ROBOTICS AND CONTROL

SYLLABUS FOR B.E. VII-SEMESTER

Instruction : 3 Hrs /week	SEE Marks : 60	Course Code : U23PC760ME
Credits : 3	CIE Marks: : 40	Duration of SEE : 3 Hours

COURSE OBJECTIVE The objective of the course is to	**COURSE OUTCOMES** On completion of the course, students will be able to
To develop the fundamental knowledge and skills required to analyze, design and control robotic systems	1. Analyze the kinematics of robotic systems and apply them to solve real world problems 2 Apply differential kinematics and statics concepts to design and control robotic systems 3 Analyze the dynamics of serial manipulators using lagrangian and Newton-Euler mechanics 4 Develop motion and force control strategies for robotic systems using feedback control techniques 5 Generate and analyze robot trajectories for various applications

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	2	2	2			2		2	2		2	3	2	1
CO2	2	2	2			2		2	2		2	3	2	1
CO3	3	3	3			3		3	3		2	3	2	1
CO4	3	2	2		3	3	3	2	2	3	3	3	2	1
CO5	2	2	2		2	2	2	2	2	2	2	3	2	1

UNIT-I

Robot Kinematics

Forward Kinematics: Forward/direct kinematic analysis of serial manipulators. Inverse Kinematics: General properties of inverse kinematic solution. Inverse kinematics of serial manipulators.

UNIT-II

Differential Kinematics and Statics

Linear and angular velocity of links, Manipulator Jacobian for serial manipulators, Jacobian Singularities, Static Analysis: Force and moment balance.

UNIT-III

Dynamics of serial manipulators

Lagrangian formulation for equations of motion for RP, RR serial manipulators, Recursive dynamics using Newton-Euler formulation of RP and RR serial manipulator.

UNIT-V

Motion and Force Control:

Decentralized Control: Independent joint control, Decentralized feed forward compensation, computed torque control

Centralized control: PD control with gravity compensation

Force Control: Passive and active compliance impedance control

UNIT-V

Trajectory Generation

Joint-Space Techniques: Cubic Polynomial Trajectories, Linear Segments with Parabolic Blends-without and with via points

Cartesian-Space Techniques: Straight line path, Circular Path, Position Planning, Orientation Planning.

Case Study: AI-Driven Trajectory Planning for Warehouse Robots

Learning Resources:

1. Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, "Robotics: Modelling, Planning and Control", Springer Science & Business Media, 2010.
2. M.W. Spong and M.Vidyasagar, "Robot Dynamics and Control", 1st Edition, John Wiley and sons,1990.
3. R.K.Mittal and I.J. Nagrath, "Robotics and Control", Tata McGraw-Hill, 2003.
4. Subir Kumar Saha, "Introduction to Robotics", Tata McGraw-Hill Education, 2014.
5. Howie M. Choset, Seth Hutchinson, Kevin M. Lynch, "Principles of Robot Motion: Theory, Algorithms, and Implementation", MIT Press, 2005.

The break-up of CIE: Internal Tests + Assignments + Quizzes

1	No. of Internal Tests:	02	Max. Marks for each Internal Test:	30
2	No. of Assignments:	03	Max. Marks for each Assignment:	10
3	No. of Quizzes:	0	Max. Marks for each Quiz Test:	--

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

ROBOTICS LAB

SYLLABUS FOR B.E. VII-SEMESTER

Instruction : 2 Hours /week	SEE Marks : 50	Course Code : U23PC731ME
Credits : 1	CIE Marks: : 30	Duration of SEE : 2 Hours

COURSE OBJECTIVE The objective of the course is to	**COURSE OUTCOMES** On completion of the course, students will be able to
model, analyses different types of industrial robotics using CAD software and 6DOF serial manipulator.	1. Modelling of various industrial robotics using ADAMS software. 2. Designing and controlling of robotic path using various sensors. 3. Analyses of forward and inverse kinematics of industrial manipulator using 6-dof serial manipulator

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	1	3		1	3						2	1	3	2
CO2	1		3	1	3						2	1	3	2
CO3	1	3		1	3						2	1	3	2

List of Experiments:

1. Formulation of DH matrix for 6-DOF U-factory lite manipulator.
2. Modeling of 6-DOF U-factory lite manipulator using CAD software.
3. Simulation of 6-DOF U-factory lite manipulator using CAD software.
4. Forward kinematic analysis of 4-DOF SCARA configuration using MATLAB.
5. Inverse kinematic analysis of 4-DOF SCARA configuration using MATLAB.
6. Modeling and simulation of 2-Link manipulator using Simscape.
7. Assembling of robot mechanical components mounting of motors, sensors, electronic circuits to the chassis.
8. Navigation and obstacle avoidance robot using ultrasonic sensor.
9. Programming and controlling a line follower Infrared Sensor.
10. Programming and controlling of mobile robot using Raspberry Pi.
11. Modeling and simulation of industry manipulator using CoppeliaSim.

12. Assembling of drone using mechanical components mounting of motors, sensors, electronic circuits
13. Forward kinematic analysis of 6-DOF Parallel manipulator
14. Inverse kinematic analysis of 6-DOF parallel manipulator

The break-up of CIE: Internal Tests + Assignments + Quizzes

No. of Internal Tests:	02	Max. Marks for Internal Test:	12
Marks for day-to-day laboratory class work			18
Duration of Internal Test: 3Hours			

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

Course Project

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P (Hrs/week): 0:0:6	SEE Marks: 50	Course Code: U23PW729ME
Credits : 3	CIE Marks: 50	Duration of SEE: 3 Hours

COURSE OBJECTIVE *The objective of the course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
Design and develop a prototype related to robotics engineering using relevant tools and techniques, write a report and give a presentation.	1. define and design the robotics problem by literature study. 2. analyze by conducting experiments and obtain relevant data. 3. develop a prototype / working model using the data obtained. 4. to work in teams and adapt for the advanced technological changes 5. make logical conclusions to justify the results.

CO-PO and CO-PSO mapping														
CO	PO mapping											PSO mapping		
	1	2	3	4	5	6	7	8	9	10	11	1	2	3
CO1	3										3	3	3	2
CO2		3	3	2	3						3	3	2	3
CO3					3	3	1	1	3		3	1	2	2
CO4								3	2	3	2	1	2	2
CO5	2	1							3	3	3	1	2	3

The department will appoint a project coordinator who will be in-charge of the following.

- Grouping of students (Maximum of 3 in a group)
- Allotment of project guide
- Project progress monitoring at regular intervals
- Attendance monitoring for those students doing project in Industry.

Project topics may be chosen by the student with advice and approval from the faculty members. Students are to be assessed and evaluated as per the following criteria.

- Problem definition based on literature study.
- Usage of modern tools.
- Analysis of the problem under consideration.
- Fabrication of the model / prototype.
- Results and conclusions.
- Team Work, Report writing & Presentation with ethics
- Project Management

Each student is required to:

1. Submit a one-page synopsis in the beginning of project work for display on the notice board.
2. Give a 20 minutes presentation through LCD power point presentation followed by a 10 minutes discussion.
3. Submit a report on the project work with list of references and slides used.

The project allotment should be completed by the IV week of VII semester so that students get enough time for completion of their project.

All the projects are to be evaluated for progress at least twice in a semester. CIE marks (30 marks) are based on the performance in the two presentations which are awarded by a committee based on project rubrics.

The SEE marks (50 marks) are awarded by an external examiner based on a viva-voce exam.

Norms of final documentation of the project report will be provided by the Department.

No. of Presentations for CIE marks	2	Max. Marks for each CIE presentation:	25
Marks are awarded based on literature study, usage advanced tools, prototype development, presentation and conclusions using rubrics.			
Duration of Presentation: 20 min			