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-20)
WITH EFFECT FROM 2023-24
(For the students admitted in 2020-21)

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	Graduates demonstrate knowledge of basic sciences and mechanical engineering.
2	Graduates demonstrate an ability to identify, formulate and solve engineering problems
3	Graduates demonstrate an ability to design and conduct experiments, analyze and interpret data.
4	Graduates demonstrate an ability to design a system, component or process as per needs and specifications
5	Graduates demonstrate skills to use modern engineering tools, software and equipment to analyze for problem solving.
6	Graduates demonstrate an ability to visualize and work on laboratory and multi disciplinary tasks.
7	Graduate shows the understanding of impact of environment and society of engineering solutions and aim to provide sustainable solutions.
8	Graduates demonstrate knowledge of professional and ethical responsibilities.
9	Graduates shall be able to work independently and also in multi disciplinary teams
10	Graduates are able to communicate effectively in both verbal and written form.
11	Graduates will demonstrate the ability to handle the projects through appropriate project management techniques.
12	Graduates develop confidence for self education and ability for life-long learning

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-20)
B.E. – MECH : SEVENTH SEMESTER (2023-2024)

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								
U20PC710ME	Thermal Turbo Machines	3	-	-	3	60	40	3
U20PC720ME	Finite Element Analysis	3	-	-	3	60	40	3
U20PE7XXME	Professional Elective – II	3	-	-	3	60	40	3
U20PE7XXME	Professional Elective – III	3	-	-	3	60	40	3
U20PE7XXME	Professional Elective – IV	3	-	-	3	60	40	3
U20HS040EH	Economics and Finance for Engineers	2	-	-	3	60	40	2
U20PEXXXME	NPTEL Course Certification	-	-	-	-	-	-	2
PRACTICALS								
U20PC711ME	Thermal Engineering Lab	-	-	2	3	50	30	1
U20PC721ME	Computer Aided Engineering Lab	-	-	2	3	50	30	1
U20PW719ME	Project Seminar	-	-	2	-	-	30	1
	TOTAL	**17**	**-**	**6**	**-**	**460**	**330**	**22**
	GRAND TOTAL	**23**				**790**		**22**

1) Student should complete one NPTEL certification course equivalent to 2 credits (8 weeks) by the end of VII semester.
2) Left over hours allotted to Sports / Library / PDC / Mentor Interaction / CC / RC / TC / CCA / ECA

List of Professional Electives - Stream wise (R-20)											
		Design engineering		Manufacturing engineering		Thermal engineering		Industrial engineering		Automobile Engineering	
		Course Code	Title	Course Code	Title	Course Code	Title	Course Code	Title	Course Code	Title
Sem VII	PE-II	U20PE710ME	Robotics	U20PE720ME	Computer Integrated Mfg.	U20PE730ME	Refrigeration and Air conditioning	U20PE740ME	Supply Chain Management	U20PE750ME	Automotive Transmission
	PE-III	U20PE760ME	Theory of Elasticity	U20PE770ME	Nano Technology	U20PE780ME	Advanced IC Engines	U20PE790ME	Production and Operations Management	U20PE712ME	Vehicle Dynamics
	PE-IV	U20PE713ME	Control Systems Theory	U20PE714ME	Additive Manufacturing Technologies	U20PE715ME	Renewable Energy Systems	U20PE716ME	Value Analysis and Value Engineering	U20PE717ME	Vehicle Body Engineering

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

THERMAL TURBO MACHINES

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:1:0	SEE Marks:60	Course Code: U20PC710ME
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*
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	12	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, various regions of flow, 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

Introduction, 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.

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 , 2007.
3. Rajput R.K. "Thermal engineering", Laxmi publications Pvt. Ltd.," 10th edition
4. Ganesan, V., "Gas Turbines", Tata McGraw Hill Book Company, New Delhi, 2010.
5. Cohen H Rogers and G.F.C. and H.I.H. Saravanamuttoo, "Gas Turbine Theory", Longman, 5th Edition, New York 2004.

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

FINITE ELEMENT ANALYSIS
SYLLABUS FOR B.E. VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks : 60	Course Code : U20PC720ME
Credits : 3	CIE Marks: 40	Duration of SEE : 3 Hours

The objectives of this course are 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.	At the end of the course, students shall be able to: 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	12	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
Introduction to Finite Element Method, stress and Equilibrium, Strain, displacement, stress– strain relations.
One dimensional problems:
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,

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.

UNIT – III: Two dimensional problems:
Element stiffness matrix for constant strain triangle element (CST), two dimensional stress analysis using CST elements and treatment of boundary conditions,

UNIT – IV
Introduction of Finite Element analysis software: Pre-processing, solution, post processing.
Mesh requirements, type of elements and their degrees of freedom, convergence requirements.
Numerical integration using Gaussian Quadrature with two and three point formulaefor one dimensional problem.
Steady state one dimensional conductionheat transfer analysis of composite wall.

UNIT – V
Dynamic Analysis: Formulation of finite element model, properties 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

ROBOTICS (PE-II)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE710ME
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*
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	12	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, Basic terminology, Basic 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 and moment transformation, Singularities, Redundancy.

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

COMPUTER INTEGRATED MANUFACTURING (PE-II)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE720ME
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*
understand the various islands of automation in an industry and also calculate the relevant parameters of automation	1 understand the effect of manufacturing automation strategies and derive production metrics. 2 analyze automated flow lines and assembly systems, and balance the line. 3 understand assembly systems with its quantitative analysis. 4 expertise in understanding automated material handling and storage systems for a typical production system. 5 understand the various inspection systems used in automation industry.

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				2								3	1
CO2				2		2								3	1
CO3			3	2	1									3	1
CO4			3		2									3	1
CO5		3													

UNIT-I: MANUFACTURING AUTOMATION

Automated Manufacturing Systems, Computerized Manufacturing Support Systems, Reasons for Automation, Automation Strategies-The USA Principle, Ten Strategies for Automation and Process Improvement, Automation Migration Strategy.

UNIT-II

Automated Flow lines: System Configurations, Workpart Transfer Mechanisms, Storage Buffers, Control of Production Line, Analysis of Transfer

Lines-Transfer Lines with No Internal Parts Storage, Transfer Lines with Internal Storage Buffers.

Manual Assembly Lines: Assembly Workstations, Work Transport Systems, Line Pacing, Coping With Product Variety, Analysis of Single Model Assembly Lines-Repositioning Losses, The Line Balancing Problem, Line Balancing Algorithms-Largest Candiate Rule, Kilbridge and Wester Method, Ranked Positional Weights Method.

UNIT-III: AUTOMATED ASSEMBLY SYSTEMS

System Configurations, Parts Delivery at Workstations, Applications, Quantitative Analysis of Assembly Systems- Parts Delivery System at Workstations, Multi-station Assembly machines, Single Station Assembly Machines, Partial Automation.

UNIT-IV: AUTOMATIC MATERIAL HANDLING AND STORAGE SYSTEMS

Design Considerations in Material Handling, Material Transport Equipment-Industrial Trucks, Automated Guided Vehicles, Monorails and Other Rail-Guided Vehicles, Conveyors, Cranes and Hoists, Analysis of Vehicle Based Systems, Conveyor Analysis. Automated Storage/Retrieval Systems, Carousel Storage Systems, Engineering Analysis of AS/RS and Carousel Systems.

UNIT-V: AUTOMATED INSPECTION SYSTEMS

Overview of Automated Identification Methods, Bar Code Technology, Radio Frequency Identification, Other AIDC Technologies-Mangnetic Stripes, Optical Character Recognition, and Machine Vision.

Learning Resources:

1. Mikell P Groover, "Automation, production Systems and Computer Integrated Manufacturing",3rd Edition, Prentice Hall Inc., New Delhi, 2007.
2. Nanua Singh, "System Approach to Computer Integrated Manufacturing", Wiley & Sons Inc., 1st Edition, 1996.
3. Andrew Kusiak, Intelligent Manufacturing System, Prentice Hall Inc., New Jersey, 1992.

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

REFRIGERATION AND AIR CONDITIONING (PE-II)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE730ME
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	12	1	2	3
CO1	2	3	2	3			2			1			1	2	3
CO2	2	3	2	3			2			1			1	2	2
CO3	2	3	3	2			2			1			1	2	2
CO4	2	3	3	2			2			1			1	2	2
CO5	2	3	3	2			2			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 ofSteam Jet Refrigeration System.

UNIT-IV

Psychrometry: Definition, properties, Psychrometric chart, Psychrometric processes – heating & cooling with humidification and dehumidification and adiabatic dehumidification, adiabatic chemical dehumidification and 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., "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 DomkundwarS,"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

SUPPLY CHAIN MANAGEMENT (PE-II)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE740ME
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*
know the significance of supply chain management in engineering, maintain inventory and pricing.	1 Discern what supply chain management concepts are used in engineering applications. 2 Understand why planning an effective transportation and warehouse management systems is essential. 3 Know how to Design effective supply chain networks. 4 Tell how to Integrate and optimize demand and supply gaps. 5 Design pricing and revenue management systems

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		1										2	1		
CO2			2											1	
CO3									1			1		1	
CO4												1		1	1
CO5												2			1

UNIT-I: INTRODUCTION-SUPPLY CHAIN MANAGEMENT (SCM)

What is supply chain?, types of supply chains, major drivers of supply chain; objectives and importance of SCM, structure of a supply chain, drivers of supply chain performance, roles of facilities, inventory, transportation, information, and pricing in SCM. Examples of supply chains. Case study: Seven-Eleven Japan Co.

UNIT-II: DESIGNING SUPPLY CHAIN NETWORK

Design options for distribution network, online sales and the distribution network, role of network design in the supply chain, factors influencing network design decisions, impact of globalization on supply chain networks.

UNIT-III: PLANNING DEMAND AND SUPPLY IN A SUPPLY CHAIN
Demand forecasting in a supply chain, role of forecasting, time-series forecasting methods, measures of forecast error, aggregate planning, and aggregate planning strategies, Supply chain planning, demand planning and forecasting operational practices in supply chain, Just-in-time, Kanban, Vendor-managed inventory, managing supply & demand,

UNIT-IV: PLANNING AND MANAGING INVENTORIES IN A SUPPLY CHAIN
Classification of inventory, role of cycle inventory in supply chain, control of inventories in retail and services, economies of scale to exploit fixed costs and quantity discounts, short-term discounting: Trade promotions, managing uncertainty: safety inventory and optimal level of product availability.

UNIT-V: DESIGNING AND PLANNING TRANSPORTATION NETWORKS: Role of transportation in supply chain, modes of transportation and their performance characteristics, design options for a transportation network, Mumbai Dabbawalla's: A highly responsive distribution network.
Sourcing Decisions in Supply Chain: Role of sourcing in a supply chain, In-house or outsource, supplier selection-auctions and negotiations.

Learning Resources:

1. Sunil Chopra & Peter Meindl, "Supply Chain Management – Strategy, Planning and Operation", 6th Edition, Pearson India Education Services Pvt. Ltd., 2018.
2. N. Chandrasekaran, "Supply Chain Management – Process, System, and Practice", Oxford University Press, 2010.
3. R. P. Mohanty, S. G. Deshmukh, "Supply Chain Management – Theory & Practices", Biztantra, New Delhi, 2010.
4. Martin Christopher, "Logistics & Supply Chain Management", 5th Edition, Financial Times Series,2010.
5. Dobler Donald. W, David N.Burt, "Purchasing &Supply Management Text & Cases", McGraw-Hill, 1996.
6. ChitaleK. Gupta R.C, "Materials Management-Text and Cases", Prentice-Hall of India Pvt. Limited, 2007.

Web Resources:
1. NPTEL :: Management - Operations and Supply Chain Management
2. NPTEL :: Management - NOC: Supply Chain Analytics

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

AUTOMOTIVE TRANSMISSION (PE-II)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE750ME
Credits : 03	CIE Marks:40	Duration of SEE: 03Hours

Course objectives *The objective of this course is to*	**Course Outcomes** *On completion of the course, students will be able to*
Study the various components of the transmission system of an automobile.	1. Calculation of gear and evaluate performance characteristics in different types of gear boxes 2. Describe the construction and working of various types of planetary gear boxes 3. Explain the working of advanced Fluid coupling and hydraulic transmission systems. 4. Explain various types of advanced automatic transmission system 5. Understand the basic terminology of Modern electric drive and summarize various hydrostatic drive systems.

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	2								2	3	2
CO2		3	2	3	3								2	3	2
CO3	3			3			2						2	3	2
CO4				2	3								2	3	2
CO5		3		3	3				3				2	3	2

UNIT – I

Gear Box: method of calculation of gear ratios for vehicles, performance characteristics in different speeds, different types of gear boxes, speed synchronizing devices, gear materials, lubrication.

UNIT – II

Spur and internal gear type planetary gearboxes, Ford T-model, Cotal and Wilson Gear box, determination of gear ratios, automatic overdrives.

UNIT – III

Fluid coupling: advantages and limitations, construction details, torque capacity, slip in fluid coupling, performance characteristics. Means used to reduce drag torque in fluid coupling.

Principal of torque conversion, single, multi stage and poly phase torque converters, performance characteristics, constructional and operational details of typical hydraulic transmission drives (e.g.) Leyland, White Hydro torque drives.

UNIT – IV

Automatic transmission: relative merits and demerits when compared to conventional transmission, automatic control of gears, study of typical automatic transmissions, Ford and Chevrolet drive, and automatic control of gear box.

UNIT – V

Hydrostatic drives: advantages and disadvantages, principles of hydrostatic drive systems, construction and working of typical hydrostatic drives, Janney Hydrostatic drive. Electrical drives: advantages and limitations, principles of Ward Leonard system of control, Modern electric drive for buses and performance characteristics.

Learning Resources:

1. Heldt P.M - Torque converters- Chilton Book Co.-1992.
2. Newton and Steeds - Motor Vehicle- Illiffee Publisher- 2000
3. Design Practices, passenger Car Automotive Transmissions-SAE Hand book- 1994
4. K.M. Gupta, Automobile Engineering,, Volume 1, Umesh Publications, 2001
5. Crouse & Anglin, “Automotive Mechanics” Mc Graw hill, 10th edition.

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

THEORY OF ELASTICITY (PE-III)
SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE760ME
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*
understand elasticity, various elastic constants, stress-strain relations and usage of various theories of failure.	1 understand the concept of stress and significance of principal stresses. 2 determine the stresses which produce volume change and shape change of the material for the applied loading conditions. 3 understand the concept of strain and significance of principal strains. 4 understand the 3-dimensional stress-strain relationships of anisotropic, orthotropic and isotropic materials. 5 calculate the strength of materials using various theories and representation using stress space diagram.

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	2	3	1	1								3	2	1
CO2	2	3	2	3	1								3	2	1
CO3	3	2	2	2	2								3	2	1
CO4	2	3	3	3	1								3	2	1
CO5	3	2	2	1	2								3	2	1

UNIT-I: BASIC CONCEPTS OF STRESS
Definition, State of stress at a point, stress tensor, invariants of stress tensor, principal stresses, stress ellipsoid.

UNIT-II: ANALYSIS OF STRESS

Derivation for maximum shear stress and planes of maximum shear stress, octahedral shear stress, deviatoric and hydrostatic components of stress, invariance of deviatoric stress tensor, plane stress.

UNIT-III: ANALYSIS OF STRAIN

Deformation tensor, strain tensor and rotation tensor; invariants of strain tensor, principal strains, derivation for maximum shear strain and planes of maximum shear strain, octahedral shear strain, deviatoric and hydrostatic components of strain tensor, invariance of deviatoric strain tensor, plane strain.

UNIT-IV: STRESS-STRAIN RELATIONS

Stress-strain relationships for an isotropic body for three dimensional stress space for plane stress and plane strain conditions, differential equations of equilibrium, compatibility equations, material (D) matrix for Orthotropic Materials.

UNIT-V: STRESS-STRAIN REPRSENTATION

True stress and true strain, Von-Mise's and Tresca yield criteria, Haigh-Westergard stress space representation of Von-Mise's and Tresca yield criteria, effective stress and effective strain.

Learning Resources:

1. Timoshenko and Goodier, "Theory of Elasticity", McGrawHill Publications 3rd Edition.
2. L.S.Srinath – Advanced Mechanics of Materials. TMH .2009
3. George E Dieter, Mechanical Metallurgy, McGraw Hill Publications 1988
4. Theory of Elasticity – Dr.Sadhusingh, Khanna Publications,2010

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

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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

NANO TECHNOLOGY (PE-III)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE770ME
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*
Learn nano scale properties, various nano materials and structures along with corresponding nano fabrication techniques, nano tribology, special nano materials and nano bio materials.	1 identify the basic concepts in nano technology and their importance 2 Analyze Various properties and microstructure of Nano materials 3 Interpret Zero and One dimensional Nano structures and their applications 4 Study various Nano Material Fabrication Techniques and their advantages 5 comprehend the engineering applications of special nano materials and nano bio materials

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	1				3	3	3				3	3	2	3
CO2	3	1				3	3	2				3	3	2	3
CO3	3	1				3	3	2				3	3	2	3
CO4	3	1				3	3	2				3	3	2	3
CO5	3	1				3	3	2				3	3	2	3

UNIT - I

Introduction: Nanoscale, Properties at Nanoscale, advantages and disadvantages, importance and challenges in Nanotechnology.

UNIT - II

Materials: Introduction, Si-based materials, Ge-based materials, Ferroelectric materials, Polymer materials, Ga As & InP (HI-V) group materials, Nano tribology and materials.

UNIT - III

Nano Structures: Zero dimensional Nanostructure, synthesis procedure by heterogeneous method, characterization techniques, properties and applications of Nano particles

One dimensional Nanostructures: Synthesis procedure, characterization procedure and principles involved, properties and applications of Nano Wires.

UNIT - IV

Nano Fabrication: Introduction, Basic fabrication techniques by Lithography and doping, MEMS fabrication techniques, Nano fabrication techniques by E-beam, Nano-imprint fabrication, Epitaxy and strain engineering

UNIT - V

Special Nano Materials: Introduction, Synthesis procedure by metal-polymer, Characterization procedures, applications

Nano Biomaterials: Introduction, Biocompatibility, anti-bacterial activity, applications

Learning Resources:

1. WilliaTllsey Atkinson, "Nano Technology", Jaico Publishing House
2. George W. Hanson, "Fundamentals of Nanoelectronics", Pearson Education, 2009
3. T. Pradeep, "Nano: Essentials-understanding Nano Science and Technology" TMH 2009

Text Books:

1. Dieter Vollath, "Nanomaterials: An introduction to Synthesis, properties and applications", Wiley, 2013
2. Guozhong Cao, "Nanostructures and Nano Materials, Synthesis properties and applications", Imperial College Press
3. Carl C Koch, "Nano materials Synthesis , Properties and applications", Jaico Publishing House

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

ADVANCED IC ENGINES (PE-III)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE780ME
Credits : 03	CIE Marks:40	Duration of SEE: 03Hours

Course Objectives	Course Outcomes
The objectives of this course are to study the working principles of operation and combustion process of different I.C. Engines. to provide knowledge on pollutant formation, control, alternate fuels and new developments in I.C. Engines.	At the end of the course student shall be able to 1. understand the combustion phenomena of SI engines and identify various factors influencing the combustion process. 2. understand the combustion phenomena of CI engines and identify various factors influencing the combustion process. 3. identify various pollutants in the combustion process of Internal Combustion Engines and study emission norms. 4. study the feasibility of alternative fuels available to replace existing fuels in IC Engines. 5. study new technologies in the field of Internal Combustion Engines.

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	2	2			2	2	2		2			3	2	1
CO2	3	2	2			2	2	2		2			3	2	1
CO3	3	2	2			2	2	2		2			3	2	1
CO4	3	2	2			2	2	2		2			3	2	1
CO5	3	2	2			2	2	2		2			3	2	1

UNIT– I

Introduction to I.C. Engines: Combustion Engine, Classification into External and Internal Combustion Engines, Sub classification of I C Engines on the basis of different considerations.

Combustion in S.I. Engine: Stages of combustion in S.I. Engines, effect of engine variables on ignition lag, effect of engine variables on flame propagation, Abnormal combustion, effects of detonation, effects of engine variables on knock or detonation, control of detonation, Primary Standard

Reference Fuels, Octane Number, SI engine combustion chamber design principles and types of combustion chambers in SI engines.

UNIT– II

Combustion in C.I. Engine: Combustion in the C.I. Engines, stages of combustion, delay period or ignition lag, variables affecting delay period, diesel knock, factors tending to reduce knocking in SI and CI engines, methods of controlling diesel knock, Primary Standard Reference Fuels, Cetane Number,CI engine combustion chambers, methods of generating air swirl in the CI engine.

UNIT-III:

Pollutant Formation and Control: Pollutants – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbons, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps –Emission norms.

UNIT– IV

Alternative Fuels: Introduction, Merits and demerits: Liquid fuels (Methanol and Ethanol), Gaseous fuels (Hydrogen, Natural gas and Liquefied Petroleum Gas) andBio-diesels.

UNIT-V

Recent Trends in I. C. Engines: Super charging and Turbo charging in I.C. Engines, Dual fuel and multi fuels engines, Lean Burn Engines, Stratified Charge Engines, homogeneous charge compression ignition (HCCI) Engines, Multi Point Fuel Injection (MPFI) systems, and Gasoline Direct Injection (GDI) concepts.

Learning Resources:

1. V. Ganesan, Internal Combustion Engines- Tata Mc Graw Hill Publications, 2008.
2. S.S. Thipse, Alternate Fuels- -Jaico Publishers, 2010.
3. Heywood J.B., Internal Combustion Engines Fundamentals- Mc Graw Hill, 1988.
4. Mathur and R. P. Sharma, Internal Combustion Engines- Dhanpat Rai and Sons Publications, 2013.
5.Ramalingam. K.K., Internal Combustion Engine Fundamentals- Scitech Publications, 2002.

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-III)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE790ME
Credits : 03	CIE Marks:40	Duration of SEE: 03Hours

Course objectives	Course Out comes
The objectives of this course are to: study the types of plant layout, forecasting methods, cost analysis, inventory control and project management.	On completion of the course, the student will be able to: 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. determine the optimal maintenance of inventory to minimise the total cost using different inventory models. 5. construct network models to estimate the project completion time using PERT and CPM techniques.

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	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. Calculations on productivity. Capacity planning and process planning calculations

Plant location and layout: Factors affecting plant location, Break even analysis, 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)

Work Study: Introduction to method study and work measurement, standard time calculations, methods of rating, work sampling.

Unit– III

Costs: Elements of Cost, overheads, determination of selling price of a product**.**

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.

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, fixed order quality system, periodic review system, Probabilistic inventory models, determination of safety stock in deterministic and probabilistic inventory models, ABC and VED analysis, problems on ABC analysis.

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, crashing of network.

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. PanneerSelvam R, "Production and Operations Management", 2nded, PHI Learning Pvt. Ltd., New Delhi, 2006.
5. S.D. Sharma, "Operations Research", Kedarnnath, Ramnath& Co., Meerut, 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

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

VEHICLE DYNAMICS (PE-III)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE712ME
Credits : 03	CIE Marks:40	Duration of SEE: 03Hours

Course objectives *The objective of this course is to*	**Course Outcomes** *On completion of the course, students will be able to*
understand vibration response characteristics and stability of dynamic systems and Analyze the damped, undamped vibration system in an Automotive	1. understand the basics of vibration, when the vehicle is at dynamic condition. 2. derive the effective cornering stiffness when considering the elastic elements in the wheel suspension and be able to analyze effect on the dynamic characteristics of the vehicle 3. understand the tyre dynamics with respect to force & moments 4. evaluate the Numerical methods for multi degree of freedom systems with different theories 5. understand the various vibration measuring instruments.

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			2	3								2	3	3
CO2	2		3	3	3								3	3	2
CO3	2		3	3	3								3	3	2
CO4	2		3	3	3				3				3	3	2
CO5	2		3	3	3								3	3	2

UNIT-I

Fundamentals of Vibration: Introduction, classification of vibration: free and forced vibration, undamped and damped vibration, response of damped and undamped systems under harmonic force, analysis of single

degree and two degree of freedom systems, torsional vibration, determination of natural frequencies.

UNIT-II

Vehicle Vibrations: Vehicle vibration with single degree of freedom free vibration, forced vibration, vibration due to road roughness, vibration due to engine unbalance, transmissibility of engine mounting vibration with two degree of freedom, free vibration, compensated suspension systems forced vibration.

UNIT-III

Different types of tyres - Materials used: Tyre construction, physics of tyre traction on dry and wet surface, tyre traction on dry and wet surface, tyre forces and moments, SAE recommended terminologies of tyre road interaction.

UNIT-IV

Numerical methods for multi degree of freedom systems: Methods, influence coefficient. Maxwell's reciprocal theorem. Dunkley's equation, orthogonality principle, method of matrix iteration - method of determination of all the natural frequencies using sweeping matrix and orthogonality principle, Holzer's method for systems with free, fixed free and fixed ends.

UNIT-V

Vibration measuring instruments - Accelerometers and vibrometers, whirling of shafts with and without air damping, discussion of speeds above and below critical speeds.

Learning Resources:

1 J S Rao V.Dukkipati, Vehicle Dynamics
2. William J Thomson, Theory of Vibration with applications.
3. William W. Seto, Theory & Problems of Mechanical Vibration. McGrawHill.
4. N.K. Giri, Problems in Automobile Mechanics, Khanna Publications.
5. S.K. Clark, Mechanics of Pneumatic Tyre. Prentice Hall.
6. Church, Mechanical Vibration, Wylie International.

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

CONTROL SYSTEMS THEORY (PE-IV)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE713ME
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*
describe physical systems through mathematical models and graphical representations and assess their response and stability in frequency and time domains and design suitable control methods.	1 develop Transfer functions for various systems using mathematical modeling. 2 simplify the systems given in pictorial representation and examine the steady state and transient behavior. 3 estimate the system behavior using Routh criterion, Root locus and Bode diagrams. 4 assess the frequency response of the control systems using Polar and Nyquist plot and explain the principle of compensators. 5 model the system in state space domain and test for controllability and observability.

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	2	1									2	3	2	1
CO2	3	2										2	3	2	1
CO3	3	2	2									2	3	2	1
CO4	3	2	1									2	3	2	1
CO5	3	2	2									2	3	2	1

UNIT-I:

CONTROL SYSTEMS CLASSIFICATION

Examples of control systems, Open Loop & Closed Loop Systems. Mathematical models and Transfer functions from governing equations of mechanical, electrical, hydraulic, pneumatic, and thermal systems. Force-Voltage and Force-Current analogy.

UNIT-II

Block diagrams, Block diagram reduction. Signal flow graphs, Mason's gain formula. Transient response of first order system to step, ramp, parabolic and impulse inputs. Time domain specifications of second order systems, Response of second order systems to Step input. Steady state error, static and dynamic error coefficients, sensitivity.

UNIT-III

Routh stability criteria, Root Locus method for negative feedback systems.

Frequency Response, Bode plots. Experimental determination of transfer functions.

UNIT-IV

Polar and Nyquist plots, Nyquist stability criteria. Gain and phase margins.

Introduction to compensator design (**qualitative treatment only**): Lead, Lag and lag–lead compensators.
PID controller, correlation between transient and frequency response.

UNIT-V

State– space representation of linear control systems. Conversion of transfer function into state space, conversion of state-space into transfer function, solution of state equations by Laplace transformation technique and time domain technique. State transition matrix. Zero input response and zero state response. Concept of controllability and observability.

Learning Resources:

1. R.C. Dorf, "Modern Control Systems", Pearson, 13th Edition, 2016.
2. M. Gopal, "Control Systems", Tata McGraw-Hill Education India, 4th Edition 2012.
3. Ogata, K. "Modern Control Engineering", Prentice Hall, 5th Edition, 2010
4. Norman S. Nise, "Control Systems Engineering", John Wiley & Sons, Inc., 7th Edition, 2015.
5. William J. Palm, III, Modelling, Analysis, and Control of Dynamic Systems, John Wiley & Sons Inc., 2nd Edition, 2013.

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

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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

ADDITIVE MANUFACTURING TECHNOLOGIES (PE-IV)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE714ME
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*
understand the fundamentals of various additive manufacturing technologies, learn different types of liquid, solid and powder based AM systems, discuss rapid tooling, applications of AM systems.	1 understand the fundamentals of Additive manufacturing Technologies to analyze Problems. 2 study the principle, process, advantages and limitations of various AM systems. 3 understand the pre and post processing steps in Additive manufacturing. 4 study various rapid tooling methods after making pattern in AM. 5 study the applications of AMT in engineering, medical and Bio engineering industries.

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	2	3	2		2	1							2	3	2
CO2	3	2	2		3	2							3	2	2
CO3	3	2	2		3	2							3	2	2
CO4	3	2	2		3	2							3	2	2
CO5	1	3	3		3	3							1	3	3

UNIT-I: **INTRODUCTION**

Prototyping fundamentals, Historical development, Fundamentals of rapid prototyping, Advantages of Rapid prototyping, commonly used terms, Rapid prototyping process chain, 3D modeling, Data Conversion, and transmission, Checking and preparing, Building, Post processing, AM data formats, Classification of AM processes.

UNIT-II: Additive Manufacturing Systems

LIQUID BASED AM SYSTEMS

Stereo lithography Apparatus (SLA): Process, working principle, Photopolymerization, Layering technology, Applications, Advantages and disadvantages.

Solid ground curing (SGC): Process, Working principle, Applications, Advantages and disadvantages.

SOLID BASED AM SYSTEMS

Laminated object manufacturing (LOM): Process, Working principle, Applications, Advantages and disadvantages.

Fused Deposition Modeling (FDM): Process, Working principle, Applications, Advantages and disadvantages.

POWDER BASED AM SYSTEMS:

Selective laser sintering (SLS): Process, Working principle, Applications, Advantages and disadvantages.

Three-dimensional printing (3DP): Process, Working principle, Applications, Advantages and disadvantages.

Case studies of the above processes(not for exam)

UNIT-III Pre and Post Processing in AM

Pre-Processing in AM: STL Format, STL file problems, STL file repairs

Post Processing of AM parts: Support material removal, Surface texture improvement, Accuracy improvement, Aesthetic improvement, Preparation for use as a pattern, Property enhancements using Non-thermal and Thermal techniques.

UNIT-IV

Rapid Tooling: Introduction to RT, conventional tooling v/s RT, need for RT, RT classification: Indirect RT methods: spray metal deposition, RTV epoxy tools, ceramic tools, Investment casting, spin casting, die casting, sand casting, 3Dkeltool process. Direct RT: direct AIM, LOM tools, DTM RT process, EOS direct tool process and direct metal tooling using 3DP.

UNIT-V

Applications of AM systems: Application – material relationship, Application in design, Application in engineering, analysis and planning, aerospace industry, automotive industry, jewelry industry, coin industry, GIS Application, arts and architecture.

RP medical and bio engineering Application: planning and simulation of complex surgery, customized implant and prosthesis, design and production of

medical devices, forensic science and anthropology, visualization of biomolecules.

Learning Resources:

1. Chua C.K., Leong K.F. abd LIM C.S., "World Rapid prototyping : Principles and Applications", 2nd Edition, Scientific Publications, 2004.
2. D.T.Pham and S.S. Dimov, "Rapid Manufacturing", Springer, 2001.
3. Amithaba Ghose, "Rapid prototyping", Eastern Law House, 1997.
4. R.B.Choudary, " A treatise on Additive Manufacturing" ,Khanna Publishers,2022.
5. Paul F. Jacobs, "Stereolithography and other RP & M Technologies", ASME Press, 1996.
6. Paul F. Jacobs, "Rapid Prototyping & Manufacturing", ASME Press, 1996.
7. Ian Gibson, David W Rosen, Brent Stucker., Additive Manufacturing Technologies:3D Printing, Rapid prototyping and direct digital manufacturing,2nd Edition, Springer,2015.

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-IV)

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week):3:0:0	SEE Marks:60	Course Code: U20PE715ME
Credits :03	CIE Marks:40	Duration of SEE:03Hours

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 explainthe 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	12	1	2	3
CO1	3	2	2			2	2	2		2			3	2	1
CO2	3	2	2			2	2	2		2			3	2	1
CO3	3	2	2			2	2	2		2			3	2	1
CO4	3	2	2			2	2	2		2			3	2	1
CO5	3	2	2			2	2	2		2			3	2	1

UNIT I

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.

Photo-voltaic Energy: Solar cells – Photo-voltaic conversion efficiency, performance characteristics of solar cells as a function of light intensity, temperature and cell area, solar cell module and arrays.

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.

Geothermal Energy: Earth as source of heat energy; Nature of Geothermal Fields, Geothermal sources. Hydrothermal sources; vapor dominated systems; Liquid dominated systems. Petro thermal systems and Geo pressure systems.

UNIT III

Ocean Thermal Energy: Ocean thermal energy sources, Ocean thermal energy power plant development; Closed and open cycles: advantages and operating difficulties.

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

Ocean Wave Energy Technology: Classification of wave energy conversion devices; working of heaving float type, pitching type, heaving and pitching float type, oscillating water column type and surge 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, Digester design considerations of 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", TataMcGraw-HillEducation 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

VALUE ANALYSIS AND VALUE ENGINEERING (PE-IV)
SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE716ME
Credits : 03	CIE Marks:40	Duration of SEE: 03Hours

Course Objectives	Course outcomes
The objectives of this course are to: 1. understand the importance of value engineering and its application in their respective fields 2. familiarize with the procedure of Value analysis and value engineering 3. implementation: of value engineering and how to get a certificate?	On completion of the course the student will be able to: 1. applying the concept of engineering to their field of engineering. 2. analyze the procedure of value analysis and value engineering and various phases of it. 3. auditing of value engineering and procedure for its certification

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	1	2	1	1	2					1	2	1	2	1
CO2	3	2	2	2	1	1					1	2	2	2	1
CO3	2	3	1	1	1	2					1	2	2	2	1

UNIT-I

Introduction: Meaning of Value Engineering (VE), Difference from other initiatives, Value and its types, Relationship between value vis-à-vis person, time and environment, History of Value Engineering / Value Analysis / Value Management, World bodies of Value Engineering & their activities, Multi-disciplinary team approach in Value Engineering study.

VALUE ENGINEERING JOB PLAN: Introduction, comparison of job plans of various value engineering. Finance and human relations in VE.

UNIT-II

ORIENTATION PHASE: training associates in Value Analysis and Value Engineering (VAVE). Different trainings and certifications available in VAVE, Method to conduct VAVE studies.

INFORMATION PHASE: information needed for VAVE, Method to collect and analyze information, ABC Analysis, Pareto Analysis, Breakeven analysis.

UNIT-III

FUNCTION ANALYSIS PHASE: Breakdown item into elements and sub-elements, questions to be asked, introduction to functions, practice session, types of functions (use and sell function), levels of function (basic and secondary), identify various functions, elements of cost, procedure for cost allocation, cost allocation to function, concept of worth, process flow for determining worth, discussions on worth, meaning of FAST, use of FAST, development history of FAST, different types of FAST. Ground rules of FAST, FAST diagram.

UNIT-IIV

CREATIVE PHASE: Definition of creativity, misconceptions about creativity, introduction to creative techniques like TRIZ, 3P, lateral adoption and others

EVALUATION PHASE: selection of criteria, feasibility analysis, weighted evaluation methods, decision matrix.

UNIT- V

RECOMMENDATION PHASE: Need for recommendation, method to make presentation, impact analysis and justification report, implementation plan, presentation skills.

IMPLEMENTATION PHASE: Detailed design, verification and validation, certification, change implementation.

AUDIT PHASE: Need for audit, types of audit, how to do audit.

Learning Resources:

1. SS.Iyer: Value Engineering: A How to Manual, New age International Publisher- 2nd edition 2009
2. Anil Kumar Mukhopadhaya:Value Engineering Mastermind: From Concept to Value Engineering Certification. SAGE, New Delhi
3. Del. L.Yonker:Value engineering analysis and methodology, CRC press, Newyork
4. Dr.M.A.Bulsara,Dr.H.R.Thakkar: Product Design And Value Engineering, charotar publishers, 1st edition 2015.
5. Lawrence D.Miles: Techniques of Value Analysis and Engineering: 3rd Edition Newyork
6. Anil Kumar Mukhopadhaya:Value Engineering Mastermind: From Concept to Value Engineering Certification, SAGE, New Delhi
7. K.R.Chari : Value engineering

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

VEHICLE BODY ENGINEERING (PE-IV)
SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE717ME
Credits : 03	CIE Marks:40	Duration of SEE: 03Hours

Course objectives *The objectiveof this course is to*	**Course Outcomes** *On completion of the course, students will be able to*
study of different types of vehicle body structures and load acting.	1. understand the constructional details, different types of car body and safety aspects. 2. describe the layout and types of bus body. 3. analyze the stresses acting on the structure by understanding the load distribution. 4. understand the design of the car body and driver's safety aspects. 5. explain the various types of materials and painting techniques used in automobiles

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		2	2	2								2	2	2
CO2	3		2		2								2	2	2
CO3	2		3	3	3								2	3	3
CO4	2		3	3	3		3						3	3	3
CO5	3		2	3	2								2	2	2

UNIT-I

Car body details: Types of Car body – Saloon, convertibles, Limousine, Estate Van, Racing and Sports car – Visibility regulations, driver's visibility, improvement in visibility and tests for visibility. Driver seat design -Car body construction-Various panels in car bodies. Safety aspect of car body.

UNIT-II

Types of bus bodydetails: based on capacity, distance travelled and based on construction.– Bus body layout for various types, Types of metal sections used – Regulations – Constructional details: Conventional and integral. Driver seat design-Safety aspect of bus body.

UNIT-III

Load Distribution: Types of load carrying structures -closed, integral, open, flat types. Calculation of loading cases- static, asymmetric, vertical loads. Load distribution, stress analysis of structure, body shell analysis.

UNIT-IV

Body: Body design requirement, car body space nomenclature. Body frame of passenger car and commercial vehicle. Different type of car door and window regulator, car roof, wind shield, car seats and their various design.
Safety aspect: Driver's safety, use of air bag and their details.

UNIT-V

Body materials: Different types of ferrous and non-ferrous materials used in vehicle such as cast iron. Steel. Alloy steel, plastic, GR.P.Glass etc. and their properties Painting: Corrosion and anticorrosion metho.Paint and painting process

Learning Resources:

1. Grouse W and Anglin D, Automotive Mechanics Tata Mcgraw Hill Publication 10th edition, 2004.
2. Jack E Rjavee, Automotive Technology- A System Approach,Thomson Asia Pvt Ltd, Singapore, 3rd edition, 2004
3. K Sing Automobile Engineering Vol-l Standard Publishers Distributor 2003
4. Sydney F Page, Body Engineering.
5. Powloski, J., "Vehicle Body Engineering", Business Books Ltd., 1998.
6. James E Duffy, "Body Repair Technology for 4-Wheelers", Cengage Learning, 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

Duration of Internal Test: 90 Minutes

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031
Department of Humanities and Social Sciences

ECONOMICS AND FINANCE FOR ENGINEERS
SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 2:0:0	SEE Marks:60	Course Code: U20HS040EH
Credits : 02	CIE Marks:40	Duration of SEE: 03Hours

Course objectives *The objectiveof this course is to*	**Course Outcomes** *On completion of the course, students will be able to*
understand the concepts and tools of economics, cost and finance that will equip them for decision making.	1. gain a conceptual understanding economics as a discipline. 2. construct a cost sheet and classify costs and make use of break-even analysis in decision making. 3. evaluate the accounting cycle and explain its importance in recording business transactions. 4. interpret the ratios and dissect comparative and common size statements. 5. compare the sources of finance and evaluate them.

Unit I:
Concepts in Economics
Scarcityof Resources-Relevance of Economics for Engineers- Scope of Managerial Economics
Law of Demand- assumptions and exceptions -Price elasticity of demand(Application-oriented approach)

Unit II:
CostAnalysis and Profit Planning
Concept of Cost -Costing –Classification of Costs –Preparation of Cost Sheet (Simple Problems)
–Breakeven Analysis(Application-oriented approach)

Unit III:
Conceptual Understanding of Accounting
Accounting Cycle-Journal-Subsidiary Books- Ledger-Trial Balance-Final Accounts (Manufacturing/Trading, Profit and Loss Account, Balance Sheet (Theory Only)

UNIT IV:

Financial Statement Analysis

Financial Statements- Meaning - Types –Purpose-Comparative and Common Size Statements

Ratio Analysis-Liquidity,Solvency, Activity & Profitability Ratios(including simple problems on Ratio Analysis)

Unit V:

Long Term Sources and Uses of Finance

Long term sources of finance-Debt, Equity, Hybrid, Start- Up finances, Crowd Funding, Peer to Peer lending platforms.

Capital Budgeting –Traditional and DCF Techniques (including simple problems)

Learning Resources:

1. S.P.Jain and K.L Narang., "Financial Accounting", Kalyani Publishers – Latest edition.
2. S.P.Jain and K.LNarang., "Cost Accounting", Kalyani Publishers, Latest edition.
3. M.Y.Khan and P.K. Jain., "Financial Management – Text, Problems and Cases", Mc Graw Hill Education Private Limited, New Delhi. Latest edition
4. M. Kasi Reddy & Saraswathi, Managerial Economics and Financial Analysis, PHI New Delhi, Latest edition.

Reference books:

1. Mehta P.L.,"Managerial Economics: Analysis,Problems and Cases", Sultan Chand and Sons. Latest edition.
2. Narayanaswamy, "Financial Accounting: A Managerial Perspective", Prentice Hall India
3. *M. L. Seth., "Micro Economics", Lakshmi Narain Agarwal.* Latest edition
4. Dr. R.P. Rustagi., "Fundamentals of Financial Management"Taxmann Publications. Latest Edition

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 ENGINEERING LAB

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 0:0:2	SEE Marks:50	Course Code: U20PC711ME
Credits : 01	CIE Marks:30	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*
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	12	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.

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

COMPUTER AIDED ENGINEERING LAB

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 0:0:2	SEE Marks:50	Course Code: U20PC721ME
Credits : 01	CIE Marks:30	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*
understand the CAE software applicability for analyzing structural and thermal problemsand 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	12	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. Introduction to FEA software. 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 and a Fin
12. Developing a 3-D Model in a modeling software and analyzing it by importing into FEA software
13. Demonstration of non-linear crash analysis.
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

PROJECT SEMINAR

SYLLABUS FOR B.E.VII-SEMESTER

L:T:P(Hrs/week): 0:0:2	SEE Marks:--	Course Code: U20PW719ME
Credits : 01	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	12	1	2	3
CO1	3											3	1	1	1
CO2		3	2	2	2							2	2	2	3
CO3					3	2	1					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-20)
B.E. – MECH : EIGHTH SEMESTER (2023-2024)

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								
U20PE8XXME	Professional Elective-V	3	-	-	3	60	40	3
U20PE8XXME	Professional Elective-VI	3	-	-	3	60	40	3
U20PW819ME	Project / Internship	-	-	12	Viva - Voce	50	50	6
	TOTAL	**6**	**-**	**12**		**170**	**130**	**12**
	GRAND TOTAL	**18**				**300**		**12**

List of Professional Electives - Stream wise (R-20)											
		Design engineering		Manufacturing engineering		Thermal engineering		Industrial engineering		Automobile Engineering	
		Course Code	Title	Course Code	Title	Course Code	Title	Course Code	Title	Course Code	Title
Sem VIII	PE-V	U20PE810ME	Product Design and Development	U20PE820ME	Introduction to Flexible Manufacturing Systems	U20PE830ME	Power Plant Engineering	U20PE840ME	Optimization Techniques	U20PE850ME	Automotive Aero Dynamics
	PE-VI	U20PE860ME	Composite Materials	U20PE870ME	Product Life Cycle Management	U20PE880ME	Computational Fluid Dynamics	U20PE890ME	Artificial Intelligence and Machine Learning	U20PE812ME	Unmanned Arial Vehicles

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

PRODUCT DESIGN AND DEVELOPMENT (PE-V)

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE810ME
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*
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 4 laws. describe the interaction between design, manufacture, quality, testing and introducing 5 new products. 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	12	1	2	3	
CO1	2		1			2	1	2		1	2		1	2	2	
CO2	2		1			2	1	2		1	2		1	2	2	
CO3	2		1			2	1	2		1	2		1	2	2	
CO4	2		1			2	1	2		1	2		1	2	2	
CO5	2		1			2	1	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: Function of design – Design with Human Machine Interaction (HMI), Collection of ideas and purpose of project. Selection criteria – screening ideas for new products using evaluation techniques. Principles of ergonomics.

UNIT – III

New Product Development: Research and new product development. Patents, definitions, patent search, patent laws, international code for patents – Intellectual Property Rights (IPR).

UNIT – IV

New Product Planning: Interaction between the functions of design, manufacture, quality, testing, and marketing. Steps for introducing new products after evaluation.

UNIT – V

Concepts in product development: estimation of costs for manufacture. Value engineering in product design, group technology, concepts of concurrent engineering.

Product life cycle management: Definition, PLM Life cycle model, threads of PLM, need for PLM, opportunities and benefits of PLM, views, components and phases of PLM, PLM feasibility study, PLM visioning.

Learning Resources:

1. Niebel BW & Draper AB, Production Design & Process Engg., Mc Graw Hill Kogakusha, 1974.
2. Harry Nystrom, Creativity and Innovation, Jhon Wiley & Sons, 1979.
3. Brain Twiss, Managing Technological Innovation, Pittman Publ. 1992.
4. Harry, B. Waton, New Product Planning, Prentice Hall Inc., 1992.
5. Chitale AK & Gupta R.C, Product Design & Manufacturing, – Prentice Hall of India, 1997.
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

INTRODUCTION TO FLEXIBLE MANUFACTURING SYSTEMS (PE-V)

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE820ME
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*
to understand all the various aspects of flexible manufacturing systems and analyze the various systems of FMS.	1 interpret the meaning and understand the importance and utility of various layouts 2 specify equipment for FMS operations after detailed study through group technology process planning and Plan for FMS operations and its schemes using JIT etc. 3 study the Various Manufacturing, Cleaning and Quality control aspects of FMS. 4 distinguish material handling requirements for traditional manufacture and those needed in FMS environment 5 specify the hardware and software requirements and integrate different subsystems

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		2		2	2			2	2			3	2	3
CO2	3	3	2		2				2	2			3	2	3
CO3	3				3	2				2			3	2	3
CO4	3	3	2		3	2				2			3	2	3
CO5	3				3					2			3	2	3

UNIT-I: EVOLUTION OF MANUFACTURING SYSTEMS

FMS definition and description, General FMS considerations, Manufacturing cells, Cellular versus Flexible Manufacturing. Systems Planning: Objective, introduction planning, preparation guidelines, the project team, supplier selection, system description and sizing, facility preparation planning, FMS layouts. Human resources: staff considerations, team work, communication and involvement, the supervisor's role, personnel selection, job classifications, employee training.

UNIT-II: MANUFACTURING'S DRIVING FORCE

Definition, description and characteristics. Just in-time manufacturing, definition and description, benefits and relationship to FMS, implementation cornerstones, quality and quantity application principles Group Technology: Concepts, classification and coding, benefits and relationship to FMS, design of group technology using rank order clustering technique.

UNIT-III: FMS DESIGN – USING BOTTLENECK, EXTENDED BOTTLENECK MODELS, PROCESSING AND QUALITY ASSURANCE

Turning centres, Machining centre, construction and operations performed, axes, programming, and format information, work-holding and work-changing equipment, automated features and capabilities, cleaning and deburring – station types and operation description, importance to automated manufacturing, coordinate measuring machines, types, construction and general function, operation cycle description, importance to flexible cells and systems.

UNIT-IV: AUTOMATED MOVEMENT AND STORAGE SYSTEMS

AGVs, Robots, automated storage and retrieval systems, storage space design, queuing carousels and automatic work changers, coolant and chip Disposal and recovery systems, auxiliary support equipment, cutting tools and tool Management – introduction, getting control of cutting tools, Tool Management, tool strategies, data transfer, tool monitoring and fault detection, guidelines, work holding considerations, General fixturing, Modular fixturing. FMS and the relationship with workstations – Manual, automated and transfer lines design aspects.

UNIT-V: FMS

Computer Hardware, Software, Communications networks and Nanotechnology – general functions, and manufacturing usages, hardware configuration, programmable logic controllers, cell controllers, communications networks. FMS implementation.

Learning Resources:

1. William Luggen, "Flexible Manufacturing Systems", Prentice-Hall, Newjersy, 1991
2. Parrish, D.J., "Flexible Manufacturing", - Butter Worths – Heinemann, Oxford, 1993.
3. Groover, M.P., "Automation, Production Systems and CI", - Prentice Hall India, 1989.
4. Kusiak, A., "Intelligent Manufacturing Systems", Prentice Hall, 1990.
5. Ranky, P.G., "Design and Operation of FMS, IFS Publishers, UK, 1988

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-V)

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE830ME
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*
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	12	1	2	3
CO1	3	2	2			2	2	2		2			3	2	1
CO2	3	2	2			2	2	2		2			3	2	1
CO3	3	2	2			2	2	2		2			3	2	1
CO4	3	2	2			2	2	2		2			3	2	1
CO5	3	2	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, Properties of Coal, Coal Handling, Fuel handling equipment and their choice, Coal storage systems.

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.

Cooling Towers and Heat rejection, Corrosion and feed water treatment.

UNIT-III:

HYDRO ELECTRIC POWER PLANT

Hydroelectric Power Plant:

Water Power, Hydrological Cycle, measurement of run-off, selection of site for a hydro electric power plant, Essential features of a hydro power plant. Hydrographs, Flow duration curve and mass curve-related numerical problems, Storage and Pondage, Classification of dams and spillways.

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, Radiation Hazards and Shielding, Radioactive waste disposal.

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, Delivery Factor, Related exercises.

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", Dhanapat 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

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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

OPTIMIZATION TECHNIQUES (PE-V)

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE840ME
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*
understand the importance of optimization to various practical problems and solve them with simple mathematical techniques.	1 apply the concept of simple mathematics for practical problem to find the best solution to it. 2 analyze the one Dimensional problem and their application to Mechanical engineering to minimize/maximize the objective function. 3 Evaluate the objective functions for constrained/ unconstrained situation for optimization. 4 Demonstrate the concept of dynamic programming techniques to solve day to day problems in a production shop floor.

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	2	3	3		2							1	1	3	2
CO2	2	3	3		2							1	1	3	2
CO3	2	3	3		2							1	1	3	2
CO4	2	3	3		2							1	1	3	2
CO5	2	3	3		2							1	1	3	2

UNIT-I

Introduction: Engineering applications, Statement of optimization, classification of optimization.

Classical optimization: Single variable, multi variable with and with optimization. Mutli variable with inequality constraints Khun -Tucker conditions**.**

UNIT-II: ONE DIMENSIONAL MINIMIZATION
Uni-modal Function, Unrestricted search, Exhaustive search, Dichtomous search, Interval Halving method, Fibonacci and golden bisection Method.

UNIT-III: NON LINEAR-UNCONSTRAINED OPTIMIZATION-I
classification, scaling of design variables, Random search methods, Univeriate search, pattern Directions, Hook Jeeves, Powel method.

UNIT-IV: NON LINEAR-UNCONSTRAINED OPTIMIZATION-II
characteristics, Random search methods, complex method, sequential linear programming, Zoutendijk's method, Penality method,

UNIT-V
Dynamic programming: Multi stage decision processes, concept of sub optimization, few example problems like System reliability, Cargo loading problems,.
Integer programming: Gomory's cutting plane method, Branch and bound method.

Learning Resources:
1. SS. Rao, "Engineering Optimization theory and practice", New age international 3rd Edition 2013.
2. K.Deb, "Engineering Optimization", New age international 3rd Edition New Delhi.
3. JasbirS.Arora,"Introduction to Optimum Design", Mc Grawhill International edition, 4th Edition Singapore.
4. J.K Sharma, "Operations Research", S Chand,9th Edition, New Delhi.

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

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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

AUTOMOTIVE AERODYNAMICS (PE-V)
SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks: 60	Course Code: U20PE850ME
Credits : 03	CIE Marks: 40	Duration of SEE: 03Hours

Course objectives *The objective of this course is to*	**Course Outcomes** *On completion of the course, students will be able to*
Study the wind effect on vehicles by automotive aerodynamics	1. understand the basic fluid theory and of vehicle aerodynamics. 2. analysis of aerodynamic drag And Apply CFD to a range of problems 3. analyzing the shape of the vehicle for optimization and understand lift, drag and down force definitions and calculations 4. evaluating and understanding of aerodynamics in automotive with wind effects 5. evaluating and explain the principles and functions of Wind Tunnels for Automotive Aerodynamic.

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	2		3	3		3						3	3	3
CO2			3	3	3								3	3	3
CO3		2	3	3	3								2	3	3
CO4	3		3	3	3								2	2	2
CO5	2		3	3	3								2	2	2

UNIT-I

Scope of automotive aerodynamics - historical development trends - Fundamental of fluid mechanics - Flow phenomenon related to vehicles - External & Internal flow problem - Resistance to vehicle motion - Performance - Fuel consumption and performance - Potential of vehicle aerodynamics.

UNIT-II

Aerodynamic Drag of Cars: Cars as a bluff body - Flow field around car - drag force - types of drag force - analysis of aerodynamic drag - drag coefficient of cars - strategies for aerodynamic development - low drag profiles.

UNIT-III

Shape Optimization of Cars: Front end modification - front and rear wind shield angle - Boat tailing - Hatch back, fast back and square back - Dust flow patterns at the rear - Effects of gap configuration - effect of fasteners.

UNIT-IV

Vehicle Handling - The origin offerees and moments on a vehicles - side wind problems - method to calculate forces and moments - vehicle dynamics under side winds - the effects of forces and moments - Characteristics offerees and moments - Dirt accumulation on the vehicle - Wind noise - drag reduction in commercial vehicles.

UNIT-V

Wind Tunnels For Automotive Aerodynamic: Principle of wind tunnel technology - Limitation of simulation - Stress with scale models - fill scale wind tunnels - measurement techniques - Equipment and transducers - road testing methods - Numerical methods.

Learning Resources:

1. Hucho.W.H., Aerodynamic of Road Vehicles, Butterworths Co., Ltd., - 1997.
2. A. Pope, Wind Tunnel Testing, John Wiley & Sons - 2nd Edition, New York 1974.
3. Automotive Aerodynamic: Update SP-706 - SAE – 1987
4. Vehicle Aerodynamics - SP-1145 - SAE - 1996.

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

COMPOSITE MATERIALS (PE-VI)

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE860ME
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*
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	12	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

Definition and classification of Composites (PMC, MMC, CMC), FRP Composites, Fiber Reinforcements: Fiber Types and its properties, Fiber Forms, matrix materials and its properties: Thermoset Matrices, Thermoplastic matrices, Applications of Composite Materials.

UNIT – II

Manufacturing Processes: Hand– Lay– Up,Spray technique Bag Molding, Autoclave processing, compression Molding, Resin Transfer Molding, Pultrusion, filament winding, Gel time test for resins, curing cycle.

UNIT-III: MICROMECHANICS OF COMPOSITES

Basic concepts: 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: MACRO MECHANICS 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, Inter laminar stresses and edge effects.

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.
Laminate Strength: First ply Failure, Fiber Failure,

Learning Resources:

1. MadhujitMukhopadhyaya, "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

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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

PRODUCT LIFE CYCLE MANAGEMENT (PE-VI)

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE870ME
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*
discuss various components of PLM like workflow, PDM process, collaborative product development, tools for communication and optimization, digital manufacturing, PLM strategy and management.	1 Understand the concepts, processes and workflow in PLM. 2 Understand the importance of the implementation of Product data management systems in PLM 3 Study the prototype development, testing, validation and marketing. 4 Study the various communicative tools of collaborative product development and gain knowledge on Design and optimization of products. 5 Understand the importance of Digital manufacturing and developing a PLM strategy and assessment.

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	2	2		2	2							3	2	3
CO2	3	2	2		2	2							3	2	3
CO3	3	2	2		2	2							3	2	3
CO4	3	2	2		2	2							3	2	3
CO5	3	2	2		2	2							3	2	3

UNIT-I

Introduction to Product Life Cycle Management: Definition, PLM Lifecycle model, Threads of PLM, Need for PLM, Opportunities and benefits of PLM, Views, Components and Phases of PLM, PLM feasibility study, PLM visioning.

PLM Concepts, Processes and Workflow

Characteristics of PLM, Environment driving PLM,PLM Elements, Drivers of PLM, Conceptualization, Design, Development, Validation, Production, Support of PLM. Case study for PLM execution.

Unit-II

Product Data Management (PDM) Process and Workflow: PDM systems and importance, reason for implementing a PDM system, financial

justification of PDM implementation. Versioning, check-in and checkout, views, Metadata, Lifecycle, and workflow. Applied problems and solution on PDM processes and workflow. Case study for implementation of PPM.

Unit-III

Collaborative Product Development : Engineering vaulting, product reuse, smart parts, engineering change management, Bill of materials and process consistency, Digital mock-up and prototype development, design for environment, virtual testing and validation, marketing collateral, case studies.

Unit-IV

Tools of Communication for collaborative work : Creation of 3DXML and CAD drawing using CAD software. Creation of an animation for assembly instructions on 3D via composer, creation of an acrobat 3D document. Applied problems and solutions on tools of communication for collaborative work.

Knowledge and optimization of design products: Know how, best practices, parameterization of design, Applied problems and Solution on optimization of products using power copy, publication, parameters, formula, rule, check, design table, configuration, reaction.

Unit-V

Digital Manufacturing-PLM: Digital manufacturing, benefits manufacturing, manufacturing the first-one, Ramp up, virtual learning curve, manufacturing the rest, production planning.

Developing a PLM strategy and conducting a PLM assessment

Strategy, Impact of strategy, implementing a PLM strategy, PLM initiatives to support corporate objectives. Infrastructure assessment, assessment of current systems and applications, two corporate case studies.

Learning Resources:

1. Grieves Michael, Product Lifecycle Management- Driving the Next Generation of Lean Thinking, McGraw-Hill, 2006. ISBN 0071452303
2. Antti Saaksvuori, AnselmiImmonen, Product Life Cycle Management - Springer, 1st Edition (Nov.5, 2003)
3. Stark, John, Product Lifecycle Management: 21st Century Paradigm for Product Realization, Springer-Verlag, 2004. ISBN 18523
4. Concurrent Engineering: Shortening Lead Times, Raising Quality, and Lowering Costs (Paperback) by John R. Hartley

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-VI)

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE880ME
Credits : 03	CIE Marks:40	Duration of SEE: 03Hours

Course objectives	Course Out comes
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	12	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 flows, CFF applications, comparison amongst Numerical, Analytical and Experimental approaches.

Review of the basic fluid dynamics: Continuity, Momentum and Energy equations, Navier Stokes equations, Reynolds and Favre averaged N– S

equations. Heat transfer conduction equation for steady and unsteady flows, 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, 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 without and with constant source term parabolic partial differential equations– Euler, Implicit method, Crank Nicholson method.

Errors, Consistency, Stability analysis – von Neumann analysis, Convergence criteria

Unit– IV

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

Viscous incompressible flow, stream function– Vorticity method.

Introduction to grid generation– Types of grid –Structured and Unstructured grids– O,H,C; Grid quality parameters: Aspect Ratio, grid density, skewness, tet Vs hex.

Unit– V

Introduction to finite volume method: Finite volume formulations for diffusion equation, 1-D steady state heat conduction without and with constant source term convection diffusion equation: Central difference scheme, Upwind scheme, Exponential scheme, power law scheme. Solution algorithm for pressure velocity coupling in steady flows 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

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING (PE-VI)

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE890ME
Credits : 03	CIE Marks:40	Duration of SEE: 03Hours

COURSE OBJECTIVE *The objectiveof this course is to*	**COURSE OUTCOMES** *On completion of the course, students will be able to*
1. Introduce artificial intelligence and problem-solving search methods 2. Present knowledge representation, reasoning, planning and decision making 3. Introduces neural network, artificial neuron, neuron properties, interference, learning algorithm along with functional models	1. understand the concept of artificial intelligence and learn various search methods 2. discuss the knowledge representation, logic with sequential control of reasoning 3. analyze reasons under uncertainty with networks, and planning with sequential and complex decisions. 4. understand the basic of machine learning and support vector machines. 5. understand decision trees and Model selection and validation

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	1		2		3		1					2	1	3	2
CO2	1		2		3		1					2	1	3	2
CO3	1		2		3		1					2	1	3	2
CO4	1		2		3		1					2	1	3	2

UNIT-I

AI and AI problem solving-Introduction to artificial Intelligence, Problem solving as state space search, Uniformed search

Problem solving by search-Heuristic search, Informed search, constraint satisfaction problems, Searching AND/OR graphs, Game playing, Minimax+Alpha-Beta.

UNIT-II

Knowledge representation and Reasoning-Introduction to knowledge representation, Propositional logic, First order logic -I, First order logic-II, Interference in first order logic-I, Interference in first order logic-II, Answer extraction, Procedural control of reasoning.

UNIT-III

Reason Under uncertainty- Reason Under uncertainty, Bayesian network, Decision network

Planning- Introduction to planning, Plan space planning, Planning graph and graph plan

Planning and decision making- Practical planning and acting, Sequential decision problems, Making complex decisions.

UNIT-IV

Machine learning

Introduction: Motivation, Different types of learning, Linear regression, Logistic regression

Gradient Descent: Introduction, Stochastic Gradient Descent, Subgradients, Stochastic Gradient Descent for risk minimization

Support Vector Machines: Hard SVM, Soft SVM, Optimality conditions, Duality, Kernel trick, Implementing Soft SVM with Kernels

UNIT-V

Decision Trees: Decision Tree algorithms, Random forests, Neural Networks: Feedforward neural networks, Expressive power of neural networks, SGD and Backpropagation

Model selection and validation: Validation for model selection, k-fold cross-validation, TrainingValidation-Testing split, Regularized loss minimization.

Learning Resources:

1. Elaine Rich and Kevin Knight, Artificial Intelligence, 2nd Edition, TataMcGraw-Hill, New Delhi, 1991
2. Jack Copeland, "Artificial Intelligence – A philosophical Introduction" Backwell publishing, 1993
3. Nils.j.Nilsson, "The quest for Artificial Intelligence" Cambridge University press, October 2009.
4. Shalev-Shwartz,S., Ben-David,S., "Understanding Machine Learning: From Theory to Algorithms", Cambridge University Press, 2014
5. Limin Fu," Neural Networks in computer intelligence" Mg-Graw hill, 1995
6. Bart Kosho " Neural Networks and fuzzy systems" Prentice hall of India, 1994
7. Mitchell Tom " Machine Learning" , Tata McGraw-Hill, 1997

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

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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-VI)

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week): 3:0:0	SEE Marks:60	Course Code: U20PE812ME
Credits : 03	CIE Marks:40	Duration of SEE: 03Hours

Courseobjectiv	**CourseOutcomes**
The objective of this Course is to understand the features of UAV, elements, navigation and guidance of UAV and to design and simulate UAV	After successfully completing the course students will be able to: 1. explain the types and characteristics of UAVs and their applications. 2. illustrate the concepts of aerodynamics of flight vehicle. 3. identify and explain the components, sensors and payload of UAVs, their navigation and guidance. 4. design and perform design, simulation and structural analysis of UAV components. 5. design and perform aerodynamic analysis of UAV components

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	2				3	3	3				3	3	2	3
CO2	3	3				3	3	2				3	3	2	3
CO3	3	2				3	3	2				3	3	2	3
CO4	3	2				3	3	2				3	3	2	3
CO5	3	2				3	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 Elements, Navigation and Guidance:

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; Case study on payloads. Introduction to navigation systems and types of guidance; Mission Planning and Control.

UNIT-IV

Design & Simulation of UAV:

Introduction to CAD; Design of UAV components; Structural Analysis using CAE; Manufacturing of the components of UAVs: 3D printing; Case studies – Design of nanosize(hand held) multirotor UAV, design of landing gear for multirotor

UNIT-V

Aerodynamic analysis: Introduction to Modeling and CFD analysis of UAV**,** Multirotor Aerodynamic Interaction and Investigation, CFD Analysis – Multi rotor, Fixed Wing for materials carbon fiber, glass fiber; case study- Small Scale UAV wing design and CFD analysis to obtain maximum efficiency, Aerodynamic and stability analysis of VTOL.

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

Project /Internship

SYLLABUS FOR B.E.VIII-SEMESTER

L:T:P(Hrs/week)::0:0:12	SEE Marks:50	Course Code: U20PW819ME
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-20)
B.E. (ME) Honours Degree Program in Robotics
(2023-2024)

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 2023-24								
U20PC760ME	Robotics and Control	3	-	-	3	60	40	3
U20PC731ME	Robotics Lab	-	-	2	3	50	30	1
U20PW729ME	Course Project	-	-	6	3	50	50	3
	TOTAL	**3**	**0**	**8**		**160**	**120**	**7**
	GRAND TOTAL	**11**				**280**		**7**
NPTEL Course (Robotics related): 12 weeks durations (V or VI -Semester)								3

VASAVI COLLEGE OF ENGINEERING (Autonomous)

IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

ROBOTICS AND CONTROL

SYLLABUS FOR B.E. VII-SEMESTER

Instruction : 3+1 Hrs /week	SEE Marks : 60	Course Code : U20PC760ME
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	12	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 RR planar manipulators.

UNIT-II

Differential Kinematics and Statics

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

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: ID control with granty compensation

Force Control: Passive and active compliance impedance control

Force control with inner position loop, inner velocity loop, parallel force / position 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.

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 : U20PC731ME
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	12	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. Modelling of 6 DOF anthropomorphic arm in ADAMS.
2. Simulation of 6 DOF anthropomorphic arm in ADAMS.
3. Forward kinematic analysis of 4 DOF SCARA Robot using MATLAB (Simscape Multi-body)
4. Inverse kinematic analysis of 4 DOF SCARA Robot using MATLAB (Simscape Multi-body)
5. Assembling of robot mechanical components mounting of motors, sensors, electronic circuits to the chassis
6. Navigation and obstacle avoidance robot using ultrasonic sensor
7. Navigation and obstacle avoidance robot using computer vision
8. Programming and controlling a line follower robot using IOT
9. Trajectory planning and navigation of an autonomous rover
10. Forward kinematic analysis of 6-DOF serial manipulator
11. Inverse kinematic analysis of 6-DOF serial manipulator

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

Note: Any 12 Experiments can be conducted

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

No. of Internal Tests:	01	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: U20PW729ME
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	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									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:	15
Marks are awarded based on literature study, usage advanced tools, prototype development, presentation and conclusions using rubrics.			
Duration of Presentation: 20 min			