

Vasavi College of Engineering (Autonomous), Hyderabad

Department of Mechanical Engineering

AY: 2019-20

OPEN ELECTIVES

B.E. III SEMESTER				
S.No.	Elective	Code	Title	credits
1	OE - I	U18OE310ME	Geometric Modelling	2
2		U18OE320ME	Mechanical Technology	2
3		U18OE330ME	Basic Heat Transfer for Electronic Systems	2
B.E. IV SEMESTER				
1	OE – II	U18OE410ME	Optimization methods	3
B.E. V SEMESTER				
1	OE – III	U18OE510ME	Introduction to Robotics	3
2		U18OE520ME	Introduction to Automobile Engineering	3
B.E. VI SEMESTER				
1	OE – IV	U18OE610ME	Additive manufacturing and its applications	3
2		U18OE620ME	Industrial Administration and Financial Management	3

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031
Department of Mechanical Engineering

GEOMETRIC MODELLING (Open Elective-I)
SYLLABUS FOR B.E.III-SEMESTER

L:T:P(Hrs/week):2:0:0	SEE Marks:60	Course Code: U18OE310ME
Credits :02	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVE	COURSE OUTCOMES
	<i>On completion of the course, students will be able to</i>
The objective of this course is to understand wire-frame modelling & transformations, surface, solid modelling and assembly modelling techniques.	1 define various geometric modelling techniques and development of wire frame modelling for synthetic entities by using mathematical equations.
	2 formulate 2D transformations for geometric model by matrix approach.
	3 development of various surfaces using surface modelling.
	4 development of solid models using various solid modelling schemes and Study various Assembly constraints, Assembly tree and develop few assembled models.

UNIT-I: INTRODUCTION TO CAD

product life cycle, conventional design and computer aided design.

Wire Frame Modelling: wire frame entities and their definitions. Interpolation and approximation of curves. Concept of parametric and non-parametric representation of circle and helix curves, demonstration of 2D geometry through CAD software.

UNIT-II: SYNTHETIC CURVES

Parametric representation of cubic spline, Bezier and B-spline curves, continuity, properties and characteristics of splines. Concepts of NURBS, synthetic curves demonstration.

2D transformation and their mathematics: Translation, scaling, rotation, Homogeneous co-ordinates, Concatenated transformations.

UNIT-III: SURFACE MODELING

Analytical surfaces: Definitions of planar, surface of revolution, Tabulated cylinder. Synthetic surfaces: Cubic and Bezier surfaces, visualization of different surfaces.

UNIT-IV: SOLID MODELLING

C-rep and B-rep and feature instancing, Octree encoding, spatial enumeration, cell decomposition, sweeping approaches. Euler's representation of solid models, creation of solid model in CAD software.

ASSEMBLY MODELING: Assembly constraints, assembly tree, top down assembly, bottom up assembly, development of a history tree for a simple assembly, demonstration of simple assembly.

Learning Resources:

1. Ibrahim Zeid, "CAD/CAM- Theory and Practice", McGraw-Hill Inc. New York, 2011.
2. Steven Harrington, "Computer graphics: a programming approach", McGraw-Hill, 1987.
3. David Rogers, J. Alan Adams, "Mathematical elements for computer graphics", McGraw Hill, 1990.
4. McConnell, J. J. "Computer graphics theory into practice", Jones and Bartlett Publishers, 2006.

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:	02	Max. Marks for each Assignment:	05
3	No. of Quizzes:	02	Max. Marks for each Quiz Test:	05
	Duration of Internal Test:	1 Hour 30 Minutes		

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

MECHANICAL TECHNOLOGY (Open Elective-I)
SYLLABUS FOR B.E.III-SEMESTER

L:T:P(Hrs/week):2:0:0	SEE Marks:60	Course Code: U18OE320ME
Credits :02	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVE	COURSE OUTCOMES
	<i>On completion of the course, students will be able to</i>
The objective of this course is to learn the basic principles of excavating equipment, conveying equipment hoisting equipment, concrete producing equipment and pneumatic equipment.	<ol style="list-style-type: none"> 1 identify the operations of various earth moving equipments for maintenance and selection with respect to their applications. 2 justify various conveying equipment for transporting material based on working principles. 3 Explain the working principles of various types of hoisting equipment in civil engineering applications. 4 examine various aggregate and concrete producing equipments used in concrete production and working of pneumatic equipment.

UNIT-I: EXCAVATING EQUIPMENT

General description, operation, maintenance and selection of Earth moving and Excavating Equipment: Shovels, Dragline, Clamshell, Cable excavator, Bucket wheel excavator, Tractor, Bulldozer, Scraper, Trenchers, Grader, Earth Compactors.

UNIT-II: CONVEYING EQUIPMENT

Belt conveyor, Screw Conveyor, Bucket Conveyor, Apron Conveyor and Aerial Ropeway.

UNIT-III: HOISTING EQUIPMENT

Hoist winch, Differential and Worm geared chain hoists, Fork lift trucks, Guyed and stiffly derricks, swing and non– swing mobile crane, whirler crane, Construction elevator, passenger lift and Bucket elevators.

UNIT-IV:

AGGREGATE AND CONCRETE PRODUCING EQUIPMENT

Crushers – Jaw, Gyratory, Hammer and Roll Crushers, Screens – Stationary, Shaking and Vibrating screens. Concrete mixers and Concrete pumps.

Pneumatic Equipment: Reciprocating air– compressor, construction pneumatic tools; jack hammer, paving breaker, Rock drill, concrete vibrator.

Learning Resources:

1. R.L. Peurifoy, “Construction Planning Equipment and Methods”, 7th Edition, McGraw-Hill Publishers, 1956.
2. Mahesh Varma, “Construction Equipment and its planning and application”, Metropolitan books Co, Delhi, 2004
3. Goodes Spence, “Building and Civil Engineering Plant”, Crosby Lock Wood, 1995.

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:	02	Max. Marks for each Assignment:	05
3	No. of Quizzes:	02	Max. Marks for each Quiz Test:	05
	Duration of Internal Test: 1 Hour 30 Minutes			

VASAVI COLLEGE OF ENGINEERING (Autonomous)
IBRAHIMBAGH, HYDERABAD – 500 031

Department of Mechanical Engineering

BASIC HEAT TRANSFER FOR ELECTRONIC SYSTEMS (Open Elective-I)
SYLLABUS FOR B.E.III-SEMESTER

L:T:P(Hrs/week):2:0:0	SEE Marks:60	Course Code: U18OE330ME
Credits :02	CIE Marks:40	Duration of SEE:03Hours

COURSE OBJECTIVE	COURSE OUTCOMES
	<i>On completion of the course, students will be able to</i>
The objective of this course is to study the basic laws of thermodynamics and the cooling of electronic equipment along with basic modes of heat transfer	1 understand and apply the first law of thermodynamics to various engineering problems
	2 understand and apply the second law of thermodynamics to various engineering problems
	3 formulate heat conduction problems in rectangular, cylindrical and spherical coordinate system by transforming the physical system into a mathematical model.
	4 analyse heat transfer processes involved in cooling of electronic components

UNIT-I: INTRODUCTION TO THERMODYNAMICS

Basic Concepts-System, Types of Systems, Control Volume, Surrounding, Boundaries, Universe, Macroscopic and Microscopic viewpoints, Thermodynamic Equilibrium, State, Property, Process, Cycle – Reversibility – Quasi-static process; Zeroth Law of Thermodynamics. Energy in state and in transition- Work and Heat. PMM I – Joule's Experiment – First law of Thermodynamics, First law applied to – process.

UNIT-II: SECOND LAW OF THERMODYNAMICS

Limitations of the First Law; Second Law of Thermodynamics- Thermal Reservoir, Heat Engine, Heat pump, Parameters of performance, Kelvin-Planck and Clausius Statements and their Equivalence / Corollaries, PMM II, Carnot cycle and its specialties, Clausius inequality, introduction to entropy.

UNIT-III: HEAT TRANSFER

Heat Transfer – Different Modes, governing laws and application to heat transfer: Fourier, Newton, Stefan-Boltzmann laws; general heat conduction equation: Cartesian co-ordinates (derivation), Steady state one-dimensional heat conduction through slabs, hollow cylinders and spheres (numericals); Concept of thermal resistance in series and parallel (composite systems), overall heat transfer coefficient; Critical radius of insulation: concept, derivation and numerical: with and without internal heat generation.

UNIT-IV: INTRODUCTION TO COOLING OF ELECTRONIC EQUIPMENT

Needs & Goals; Temperature effects on different failure modes; Electronic equipment for airplanes, missiles, satellites and spacecraft; electronic equipment for ships & submarines; electronic equipment for communication systems and ground support system; chassis and circuit boards cooling.

Learning Resources:

1. P.K. Nag, "Engineering Thermodynamics", Tata Mc Graw Hill, 4th Edition, 2008.
2. Yunus Cengel & Boles, "Thermodynamics – An Engineering Approach", TMH New Delhi, 2008.
3. Sachadeva R.C., "Fundamentals of Engineering Heat and Mass Transfer", New Age International (P) Ltd Publishers, New Delhi, 2010.
4. Dave S. Steinberg, "Cooling Techniques for Electronic Equipment", Second Edition, John Wiley & Sons, 1991.
5. Yunus Cengel & Afshin J Ghajar, "Heat and Mass Transfer: Fundamentals & its Applications", Mc Graw Hill, 5th Edition, 2013.

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:	02	Max. Marks for each Assignment:	05
3	No. of Quizzes:	02	Max. Marks for each Quiz Test:	05
	Duration of Internal Test:	1 Hour 30 Minutes		

DEPARTMENT OF MECHANICAL ENGINEERING
SYLLABUS FOR B.E. IV-SEMESTER
OPTIMIZATION METHODS (Open Elective-II)

Instruction : 3Hours /week	SEE Marks : 60	Course Code : U18OE410ME
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

Course Objectives	Course Outcomes
<p>The objectives of this course are to:</p> <p>understand Linear & non-linear programming, transportation modeling , CPM & PERT for project scheduling and control, and application of various optimization techniques for respective field engineering (Inter disciplinary)</p>	<p>On completion of the course, the student will be able to:</p> <ol style="list-style-type: none"> 1. Optimization of resources in multi disciplinary areas through linear programming under different conditions. 2. Sensitivity analysis of a linear programming problem as per customer requirements to suit various Organizations. 3. Minimization of total cost to apply for transportation techniques for the transshipment of Goods and products and Implement techniques like project management to analyze about material management. 4. Optimization of resources in multi disciplinary areas through non-linear programming under different conditions.

UNIT-I

Optimization-An overview

Meaning of Optimization-Origin of Optimization-Introduction to Linear programming problems (LPP) - Formulation of LPP- Graphical method, simplex method.

UNIT-II

Advanced topics in Linear programming

Duality in LPP, Differences between primal and dual, shadow prices, Dual simplex method, sensitivity analysis. special cases in LPP.

UNIT-III

Transportation Model

Definition of the transportation model-matrix of Transportation model-Formulation and solution of transportation models- Methods for calculating Initial basic feasible solution-Optimization of transportation model using MODI method.

Project Scheduling

Introduction to network analysis, Rules to draw network diagram, Fulkerson rule for numbering events, Critical path method, PERT.

UNIT-IV

Non linear programming problems

Optimization methods for single variable, multivariable functions, Maxima-Minima

One Dimensional Minimization: Uni-modal Function, Unrestricted search, Exhaustive search, Dichotomous search, Interval Halving method, Fibonacci and golden bisection Method , Newton and Quasi Newton method.

UNIT-V

Non Linear - Unconstrained optimization: classification, scaling of design variables, Random search methods, Univariate search, pattern Directions, Hook Jeeves, Powel method, Rosenbrock method.

Learning Resources:

1. Singiresu S. Rao, "Engineering optimization- Theory and Practice", 4th Edition, John Wiley and Sons, 2009.
2. NVS Raju, "Optimization methods for Engineers ", PHI Learning Pvt. Ltd., 2014.
3. Prem Kumar Gupta and Dr. DS Hira, "Operations Research ", S.Chand & Company Pvt. Ltd., 2014.
4. R. Panierselvam, "Operations Research", PHI Learning Pvt Ltd., 2009.
5. Kalyanmoy Deb, Optimization for Engineering Design- algorithms and examples, PHI pvt ltd, 1st edition 2003, Delhi.

VASAVI COLLEGE OF ENGINEERING (Autonomous)
 IBRAHIMBAGH, HYDERABAD – 500 031
DEPARTMENT OF MECHANICAL ENGINEERING
 SYLLABUS FOR B.E. V-SEMESTER
INTRODUCTION TO ROBOTICS (Open Elective-III)

Instruction : 3 Hours	SEE Marks : 60	Course Code : U18OE510ME
Credits : 3	CIE Marks: : 40	Duration of SEE : 3 Hours

Course objectives	Course Out comes
The objectives of this course are to: Identify robots and its peripherals for satisfactory operation and control of robots for industrial and non-industrial applications.	On completion of the course, the student will be able to 1. understand the anatomy of the robot and various robot configurations for it's selection depending on the task. 2. classify the end effectors , understand different types of joints,various types of mechanical actuation and robot drive systems for carrying out the assigned job effectively. 3. analyze a planar manipulator through forward kinematics and understand the control of robot manipulator for better reliability and efficiency. 4. classifythe various sensors used in robots for proper selection to an application. 5. summarize various industrial and non-industrial applications of robots for their selection to a particular task.

UNIT-I

ROBOT BASICS

Robot-Basic concepts, Need, Law, History, Anatomy, specifications.
 Robot configurations-cartesian, cylindrical, polar ,articulated and SCARA.
 Robot wrist mechanism, Precision and accuracy of robot.

UNIT-II

ROBOT ELEMENTS

End effectors-Classification, Types of Mechanical actuation, Gripper design, Robot drive system types: Electrical, pneumatic and hydraulic. Position and velocity feedback devices, Robot joints and links-Types, Motion interpolation.

UNIT-III

ROBOT KINEMATICS AND CONTROL

Robot kinematics – Basics of direct and inverse kinematics, Robot trajectories, 2D and 3D Transformation- Scaling, Rotation and Translation, Homogeneous transformation. D-H matrix. Forward kinematics for a 2-link RR planar manipulator.
 Control of robot manipulators – Point to point and Continuous Path Control. Robot programming.

UNIT-IV

ROBOT SENSORS

Sensors in robots – Touch sensors-Tactile sensors – Proximity and range sensors. Force sensors, Light sensors, Pressure sensors.
 Introduction to Machine Vision and Artificial Intelligence.

UNIT-V

ROBOT APPLICATIONS

Applications of robots in Industries, Medical, Household, Entertainment, Space, Underwater, Defense, and Disaster management.
 Applications of Micro and Nanorobots, Future Applications of robots.

Learning Resources:

1. MikellP. Groover, Mitchell Weiss, Roger N Nagel and Nicholas G Odrey, "Industrial Robotics Technology, Programming and Applications", TataMcGraw-Hill Publishing Company Limited , 2008.
2. Deb.S.R and Sankha Deb, "Robotics Technology and Flexible Automation", Tata McGraw HillPublishing Company Limited, 2010.
3. KlafterR.D, Chmielewski T.A, and Negin. M, "Robotic Engineering: An Integrated Approach", Prentice Hall of India Pvt. Ltd.,1994.
4. K.S. Fu,R.C. Gonzalez and C.S.G.Lee , "Robotics control, sensing, vision and intelligence",TataMcGraw-Hill Publishing Company Limited, 2008
5. R.K. Mittal and I.J.Nagrath"Robotics and Control", Tata McGraw-Hill Publishing Company Limited,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: **1 Hour 30 Minutes**

VASAVI COLLEGE OF ENGINEERING (Autonomous)
 IBRAHIMBAGH, HYDERABAD – 500 031
DEPARTMENT OF MECHANICAL ENGINEERING
SYLLABUS FOR B.E. V-SEMESTER
INTRODUCTION TO AUTOMOBILE ENGINEERING (OE-III)

Instruction : 3Hours	SEE Marks : 60	Course Code : U18OE520ME
Credits : 3	CIE Marks : 40	Duration of SEE : 3 Hours

Course objectives	Course Outcomes
The objectives of this course are to: <ol style="list-style-type: none"> 1. familiarize the student with the different types of automobiles and engine components. 2. impart adequate knowledge in fuel supply, cooling, lubrication systems of IC engines. 3. understand the steering geometry, steering mechanism and types of suspension systems. 4. gain the knowledge about working of clutch, gear mechanism, brakes 5. make the student conversant with types of wheels, tyres and pollution control techniques. 	On completion of the course, the student will be able to: <ol style="list-style-type: none"> 1. identify types of Automobiles and engine components. 2. describe the engine fuel system in petrol and Diesel engines, cooling, lubrication systems. 3. describe the steering mechanism, suspension systems 4. analyse the working principle and operation of clutch, gear mechanism and brakes. 5. know the pollutants from automobile and pollution control techniques and identify the types of wheels, tyres.

UNIT-I

Introduction: Types of automobiles: Hybrid Vehicles, Electrical, gas and Fuel cell vehicles. Chassis and body, Lay out of transmission system, Engine components: cylinder block, cylinder head, crankcase, crank shaft and cam shaft. Types of IC Engines: SI and CI engines, two stroke and four stroke engines.

UNIT-II

Fuel system: Fuel supply system for SI engines and CI engines. Simple carburettor, Introduction to Multipoint fuel injection system (**MPFI**) of petrol engines and Introduction to **CRDI** system for diesel engines.

Cooling system: air cooling, water cooling: Thermo syphon, pump circulation system.

Lubrication system: Petroil System, splash system, pressure lubrication: Wet sump and Dry Sump.

Ignition system: Battery Ignition System, Magneto Ignition System and Electronic Ignition System.

UNIT-III

Suspension system: Rigid axle, Independent suspension system: Double wish bone type, Macpherson strut system, Air suspension system.

Steering system: front axle, wheel alignment, steering geometry: camber, caster, toe-in, toe-out, steering linkage for vehicle with rigid axle front suspension, steering linkage for vehicle with independent front suspension, Ackermann steering mechanism.

UNIT –IV

Power Train: Single plate clutch, Multi plate clutch. Manual Gear Box: sliding mesh gear box, constant mesh gear box, synchromesh gear box and Automatic Gear Box. Working principle of Differential.

Brakes: Types: Drum and Disc brakes, Mechanical and Hydraulic Brakes, **ABS** system.

UNIT –V

Wheels and Tyres: Types of Wheels: wire wheels, disc wheels, alloy wheels. Types of tyres: Tube type, tubeless type. **SRS** Airbag system.

Automobile Emissions and control: Automobile pollutants and sources of pollution. Pollution Control Techniques: Catalytic Converters, EGR and PCV. Bharath emission Norms.

Learning Resources:

1. Crouse & Anglin, "Automobile Engineering", 10th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2007.
2. Kirpal Singh, "Automobile Engineering", Vol.I& II, 13th Edition, Standard Publishers, New Delhi 2013.
3. R.B Gupta, "Automobile Engineering" 7th Edition, Satya Prakashan, New Delhi, 2015.
4. Joseph Heitner, "Automotive Mechanics", 2nd Edition, Affiliated East West Pvt. Ltd., 2013.
5. C.P. Nakra, "Basic Automobile Engineering", 7th Edition, Dhanpat Rai Publishing C (P) Ltd., 2016.

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:	1 Hour 30 Minutes		

DEPARTMENT OF MECHANICAL ENGINEERING
SYLLABUS FOR B.E. VI-SEMESTER
ADDITIVE MANUFACTURING AND ITS APPLICATIONS (OE-IV)

Instruction : 3 Hours	SEE Marks : 60	Course Code : U18OE610ME
Credits : 3	CIE Marks: 40	Duration of SEE : 3 Hours

Course objectives	Course Outcomes
The objectives of this course are to : understand the fundamentals of various additive manufacturing technologies and their applications in Engineering Industry.	On completion of the course the student will be able to: 1. understand the fundamentals of prototyping. 2. study the principle, process, advantages and limitations of liquid based AM systems. 3. study the principle, process, advantages and limitations of solid based AM systems. 4. study the principle, process, advantages and limitations of powder based AM systems. 5. study the applications of AMT in various engineering industries.

UNIT-I

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

UNIT-II

Liquid based AM systems: Stereolithography Apparatus(SLA): Models and specifications, Process, Working principle, photopolymers, Photopolymerisation, Layering technology, laser and laser scanning, Applications, Advantages and disadvantages, Case studies
 Solid ground curing(SGC): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies

UNIT-III

Solid based AM systems: Laminated object manufacturing(LOM): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies.
 Fused Deposition Modeling (FDM): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies.

UNIT-IV

Powder based AM systems: Selective laser sintering(SLS): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies.
 Three dimensional printing (3DP): Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies.

UNIT-V

Applications of AM systems: Applications in aerospace industry, automotive industry, jewellery 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 bio-molecules.

Learning Resources:

1. Chua C.K., Leong K.F. and 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. AmithabaGhose, "Rapid prototyping", Eastern Law House, 1997.
4. Paul F.Jacobs, "Stereolithography and other RP & M Technologies", ASME Press, 1996.
5. Paul F.Jacobs, "Rapid Prototyping & Manufacturing", ASME Press, 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: **1 Hour 30 Minutes**