



VEL TECH MULTI TECH Dr RANGARAJAN Dr.SAKUNTHALA ENGINEERING COLLEGE

(An ISO 9001: 2008 Certified Institution)
(Owned by 'VEL Shree R. Rangarajan
Dr. Sakunthala Rangarajan Educational Academy)
(Approved by AICTE, New Delhi &
Govt. of Tamil Nadu and affiliated to Anna University)



SYLLABUS

WEEKLY SCHEDULE

IV SEMESTER 2015-16

DEPARTMENT OF MECHANICAL

IV YEAR DEGREE COURSE

42, Avadi – Alamathi Road,
Chennai – 600062
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Programme Educational Objectives

The PEO of the Mechanical Engineering programme is to enable the students to:

- I. Graduates will apply their knowledge and skills, to solve the problems in the field of Mechanical Engineering occurring in industries and transportation
- II. Graduates of the programme will employment as Mechanical engineers in engineering and business or will be admitted for higher studies
- III. Graduates of the programme will solve problem with professionalism
- IV. Graduates will be taught and exposed to the emerging technologies to cope up with technological obsolescence

Programme Outcomes

- a. Graduates will demonstrate knowledge of engineering mathematics, physics, chemistry and mechanical engineering
- b. Graduates will demonstrate the ability to design and analyze machine elements and mechanisms
- c. Graduates will demonstrate the ability to design and analyze thermal systems
- d. Graduates will demonstrate the ability to manufacture automobile components and related system
- e. Graduates will demonstrate skills to use latest CAD/CAM/CAE software and sophisticated equipments for analyzing and solving mechanical engineering problems
- f. Graduates will acquire leadership, entrepreneurship qualities and demonstrate knowledge of professional practice and team-work
- g. Graduates will demonstrate an ability to effectively communicate technical information in speech, presentation and in writing
- h. Graduates will acquire skills and ability for life-long learning
- i. Graduates will be able to participate and succeed in competitive examinations like IES, GATE etc.

Department's Vision

“To emerge as a department for mechanical engineering nurturing, excellence in education and in the emerging areas of mechanical, thermal, manufacturing and automobile disciplines.”

Department's Mission

“To build a centre for renewable energy with generation and utilization.”

“To nurture the creativity and innovation of young minds”.

“To provide consultancy to industries, and take up joint projects with industry.”

“To establish Research and Development centers with emphasis on minimization of carbon foot prints”.

“To develop the center of excellence for technology transfer in industrial automation”.

WEEKLY SCHEDULE
ACADEMIC YEAR: 2015-16

Sl.No	WEEKS	DATE	
		FROM	TO
1	WEEK1	18.01.16	23.01.16
2	WEEK2	25.01.16	30.01.16
3	WEEK3	01.02.16	06.02.16
4	WEEK4	08.02.16	13.02.16
5	WEEK5	15.02.16	20.02.16
6	WEEK6	22.02.16	27.02.16
7	WEEK7	29.02.16	05.03.16
8	WEEK8	07.03.16	12.03.16
9	WEEK9	16.03.16	20.03.16
10	WEEK10	22.03.16	26.03.16
11	WEEK11	27.03.16	02.04.16
12	WEEK12	03.04.16	09.04.16
13	WEEK13	11.04.16	16.04.16
14	WEEK14	18.04.16	23.04.16
15	WEEK 15	25.04.16	30.04.16

SUBJECT CONTENTS

SL.NO	SUBJECT CODE	SUBJECT NAME
THEORY		
1	MA6452	Statistics and Numerical Methods
2	ME6401	Kinematics of Machinery
3	ME6402	Manufacturing Technology– II
4	ME6403	Engineering Materials and Metallurgy
5	GE6351	Environmental Science and Engineering
6	ME6404	Thermal Engineering
PRACTICAL		
7	ME6411	Manufacturing Technology Laboratory – II
8	ME6412	Thermal Engineering Laboratory – I
9	CE6315	Strength Of Materials Laboratory

TEST SCHEDULE

SL.NO	SUBJECT CODE	SUBJECT NAME	UNIT TEST I	UNIT TEST II	PRE MODEL EXAM	MODEL EXAM
1	MA6452	Statistics and Numerical Methods	01.02.16	15.02.16	29.02.06	01.04.16
2	ME6401	Kinematics of Machinery	02.02.16	16.02.16	01.03.16	04.04.16
3	ME6402	Manufacturing Technology– II	03.02.16	17.02.16	02.03.16	06.04.16
4	ME6403	Engineering Materials and Metallurgy	04.02.16	18.02.16	03.03.16	08.04.16
5	GE6351	Environmental Science and Engineering	05.02.16	19.02.16	04.03.16	11.04.16
6	ME6404	Thermal Engineering	06.02.15	20.02.16	05.03.16	13.04.16

MA 2266 STATISTICS AND NUMERICAL METHODS

WEEK: 1 - TESTING OF HYPOTHESIS (UNIT 1)

Large sample test based on Normal distribution for single mean and difference of

WEEK: 2 means tests based on t and F distributions for testing means and variances contingency table (Test for Independency) – Goodness of fit.**UNIT TEST I**

WEEK: 3 DESIGN OF EXPERIMENTS (UNIT 2)

One way and two way classifications -Completely randomized design

WEEK: 4

Randomized block design

WEEK: 5

Latin square design - 2^2 -factorial design

WEEK: 6 UNIT TEST II

WEEK: 7 – SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS (UNIT 3)

Newton-Raphson method- Gauss Elimination method – Pivoting - Gauss-Jordan methods

WEEK: 8

Iterative methods of Gauss Jacobi and Gauss-Seidel – Matrix Inversion by Gauss-Jordan method - Eigen values of a matrix by Power method

WEEK: 9 UNIT TEST III

WEEK: 10-INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION (UNIT 4)

Lagrange's and Newton's divided difference interpolation –Newton's forward and backward difference interpolation

WEEK: 11

Approximation of derivatives using interpolation polynomials -
Numerical integration using Trapezoidal and Simpson's 1/3 rules

WEEK: 12 UNIT TEST IV**WEEK: 13 - NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS (UNIT 5)**

Taylor's series method - Euler's method - Modified Euler's method -
Fourth order Runge - Kutta method for solving first and second order
equations

WEEK: 14

Milne's predictor corrector methods for solving first order equations -
Finite difference methods for solving second order equation

WEEK: 15 UNIT TEST V**WEEK: 16 MODEL EXAM****WEEK: 17 MODEL EXAM****TEXT BOOKS**

1. Johnson. R.A., and Gupta. C.B., "Miller and Freund's Probability and Statistics for Engineers", 11 th Edition, Pearson Education, , Asia, 2011.
2. Grewal. B.S., and Grewal. J.S., "Numerical Methods in Engineering and Science", 9th Edition, Khanna Publishers, New Delhi, 2007.

ME6401 KINEMATICS OF MACHINERY**WEEK: 1 - BASICS OF MECHANISMS (UNIT 1)**

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law – Kinematic inversions of four-bar chain and slider crank chains Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

WEEK: 2 UNIT TEST I

WEEK: 3 – KINEMATICS OF LINKAGE MECHANISMS (UNIT 2)

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons

WEEK: 4

Velocity analysis using instantaneous centres -Kinematic analysis of simple mechanisms – Coincident points

WEEK: 5

Coriolis component of Acceleration – Introduction to linkage synthesis problem.

WEEK: 6 UNIT TEST II

WEEK: 7 – KINEMATICS OF CAM MECHANISMS (UNIT 3)

Classification of cams and followers – Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions –

WEEK: 8

Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

WEEK: 9 UNIT TEST III

WEEK: 10 - GEARS AND GEAR TRAINS (UNIT 4)

Law of toothed gearing – Involute and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting.

WEEK: 11

Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

WEEK: 12 UNIT TEST III

WEEK: 13 - FRICTION IN MACHINE ELEMENTS (UNIT 5)

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads –Bearings and lubrication –

WEEK: 14

Friction clutches – Belt and rope drives – Friction in brakes- Band and Block brakes.

WEEK: 15 UNIT TEST V

WEEK: 16 MODEL EXAM

WEEK: 17 MODEL EXAM

TEXT BOOKS:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., “Theory of Machines and Mechanisms”, 3rd Edition, Oxford University Press, 2009.
2. Rattan, S.S, “Theory of Machines”, 3rd Edition, Tata McGraw-Hill, 2009.

ME6402 MANUFACTURING TECHNOLOGY - II

WEEK: 1 - THEORY OF METAL CUTTING (UNIT 1)

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools – nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials. Tool wear, tool life, surface finish, cutting fluids

WEEK: 2 UNIT TEST I

WEEK: 3 TURNING MACHINES (UNIT 2)

Centre lathe, constructional features, cutting tool geometry, various operations, taper turning methods, thread cutting methods, special attachments

WEEK: 4

Machining time and power estimation, Capstan and turret lathes – automats

WEEK: 5

Single spindle, Swiss type, automatic screw type, multi spindle

WEEK: 6 UNIT TEST II

WEEK: 7 – SHAPER, MILLING AND GEAR CUTTING MACHINES (UNIT 3)

Shaper - Types of operations. Drilling, reaming, boring, Tapping. Milling operations-types of milling cutter.

WEEK: 8

Gear cutting – forming and generation principle and construction of gear milling, hobbing and gear shaping processes –finishing of gears.

WEEK: 9 UNIT TEST III

WEEK: 10- ABRASIVE PROCESSES AND BROACHING (UNIT 4)

Abrasive processes: grinding wheel – specifications and selection, types of grinding process – cylindrical grinding, surface grinding, centre less grinding and internal grinding-

WEEK: 11

Typical applications –concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

WEEK: 12 – UNIT TEST IV

WEEK: 13 - CNC MACHINING (UNIT 5)

Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre,

WEEK: 14

Part programming fundamentals CNC – manual part programming – micromachining – wafer machining

WEEK: 15 UNIT TEST V

WEEK: 16 MODEL EXAM

WEEK: 17 MODEL EXAM

TEXT BOOKS:

1. Hajra Choudhury, "Elements of Workshop Technology", Vol.II., Media Promoters
2. Rao. P.N "Manufacturing Technology - Metal Cutting and Machine Tools", Tata McGraw-Hill, New Delhi, 2003.

ME6403 ENGINEERING MATERIALS AND METALLURGY

WEEK: 1 - ALLOYS AND PHASE DIAGRAMS (UNIT 1)

Constitution of alloys – Solid solutions, substitutional and interstitial Phase diagrams, Isomorphous, eutectoid, eutectic, paratactic, and peritectoid reactions Iron – Iron carbide equilibrium diagram. Classification of steel and cast Iron, microstructure, properties and applications

WEEK: 2 UNIT TEST I

WEEK: 3– HEAT TREATMENT (UNIT 2)

Definition – Full annealing, stress relief, recrystallisation and spheroidizing –normalising, hardening and tempering of steel, Isothermal transformation diagrams.

WEEK: 4

Cooling curves superimposed on I.T. diagram, CCR - Hardenability, Jominy end quench test – Austempering Martempering

WEEK: 5

case hardening - carburising, nitriding, cyaniding, carbonitriding, flame and induction hardening Vacuum and Plasma hardening

WEEK: 6 UNIT TEST II

WEEK: 7 – FERROUS AND NON-FERROUS METALS (UNIT 3)

Effect of alloying additions on steel- α and β stabilisers– stainless and tool steels – HSLA, Maraging steels – Cast Iron - Grey, white, malleable, spheroidal

WEEK: 8 Alloy cast irons, Copper and copper alloys – Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

WEEK: 9 UNIT TEST III

WEEK: 10 - NON-METALLIC MATERIALS (UNIT 4)

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET, PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)

WEEK: 11

Engineering Ceramics – Properties and applications of Al₂O₃, SiC, Si₃N₄, PSZ and SIALON – Composites – Classifications – Metal Matrix and FRP - Applications of Composites.

WEEK: 12 UNIT TEST IV

WEEK: 13 - MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS (UNIT 5)

Mechanisms of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads –

WEEK: 14

Hardness tests (Brinell, Vickers and Rockwell), hardness tests, Impact test Izod and Charpy, fatigue and creep failure mechanisms.

WEEK: 15 UNIT TEST V

WEEK: 16 MODEL EXAM

WEEK: 17 MODEL EXAM

TEXT BOOKS:

1. Avner, S.H., “Introduction to Physical Metallurgy”, McGraw Hill Book Company, 1994.
2. Williams D Callister, “Material Science and Engineering” Wiley India Pvt Ltd, Revised Indian Edition 2007

GE6351 ENVIRONMENTAL SCIENCE AND ENGINEERING

WEEK: 1 - ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY (UNIT 1)

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – bio geographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels. India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

WEEK: 2 UNIT TEST I

WEEK: 3 ENVIRONMENTAL POLLUTION (UNIT 2)

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry

WEEK: 4

Mitigation procedures- Control of particulate and gaseous emission, Control of SO₂, NO_X, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment

processes

WEEK: 5

(c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

WEEK: 6 UNIT TEST II

WEEK:7 – NATURAL RESOURCES (UNIT 3)

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources.

WEEK: 8

Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

WEEK: 9 UNIT TEST III

WEEK: 10 - SOCIAL ISSUES AND THE ENVIRONMENT (UNIT 4)

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization environmental ethics:

WEEK: 11

Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). Enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

WEEK: 12 UNIT TEST IV

WEEK: 13 - HUMAN POPULATION AND THE ENVIRONMENT (UNIT 5)

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education –

WEEK: 14

HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

WEEK: 15 UNIT TEST V

WEEK: 16 MODEL EXAM

WEEK: 17 MODEL EXAM

TEXT BOOKS:

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004.

2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.

ME6404 THERMAL ENGINEERING

WEEK: 1 - GAS POWER CYCLES (UNIT 1)

Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure, and air standard efficiency - Comparison of cycles.

WEEK: 2 UNIT TEST I

WEEK: 3 – INTERNAL COMBUSTION ENGINES (UNIT 2)

Classification - Components and their function. Valve timing diagram and port timing diagram – actual and theoretical p-V diagram of four stroke and two stroke engines.

WEEK: 4

Simple and complete Carburettor. MPFI, Diesel pump and injector system. Battery and Magneto Ignition System –

WEEK: 5

Principles of Combustion and knocking in SI and CI Engines. Lubrication and Cooling systems. Performance calculation.

WEEK: 6 UNIT TEST II

WEEK: 7 – STEAM NOZZLES AND TURBINES (UNIT 3)

Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow.

WEEK: 8

Impulse and Reaction principles, compounding, velocity diagram for simple and multi-stage turbines, speed regulations –Governors.

WEEK: 9 UNIT TEST III

WEEK: 10 AIR COMPRESSOR (UNIT 4)

Classification and working principle of various types of compressors, work of compression with and without clearance

WEEK: 11

Volumetric efficiency, Isothermal efficiency and Isentropic efficiency of reciprocating compressors, Multistage air compressor and inter cooling –work of multistage air compressor

WEEK: 12 UNIT TEST IV

WEEK: 13 - REFRIGERATION AND AIR CONDITIONING (UNIT 5)

Refrigerants - Vapour compression refrigeration cycle- super heat, sub cooling – Performance calculations - working principle of vapour absorption system,

WEEK: 14

Ammonia –Water, Lithium bromide – water systems (Description only). Air conditioning system - Processes, Types and Working Principles. - Concept of RSHF, GSHP, ESHF- Cooling Load calculations.

WEEK: 15 UNIT TEST V

WEEK: 16 MODEL EXAM

WEEK: 17 MODEL EXAM

TEXT BOOKS:

1. Rajput. R. K., “Thermal Engineering” S.Chand Publishers, 2000
2. Kothandaraman.C.P., Domkundwar. S,Domkundwar. A.V., “A course in thermal Engineering”, Fifth Edition, ”Dhanpat Rai & sons , 2002

ME6411 MANUFACTURING TECHNOLOGY LABORATORY – II

LIST OF EXPERIMENTS:

1. Contour milling using vertical milling machine
2. Spur gear cutting in milling machine
3. Helical Gear Cutting in milling machine
4. Gear generation in hobbing machine
5. Gear generation in gear shaping machine
6. Plain Surface grinding
7. Cylindrical grinding
8. Tool angle grinding with tool and Cutter Grinder
9. Measurement of cutting forces in Milling / Turning Process
10. CNC Part Programming.

ME6412 THERMAL ENGINEERING LABORATORY – I

LIST OF EXPERIMENTS

I.C. ENGINE LAB

1. Valve Timing and Port Timing diagrams.
2. Actual p-v diagrams of IC engines.
3. Performance Test on 4 – stroke Diesel Engine.
4. Heat Balance Test on 4 – stroke Diesel Engine.
5. Morse Test on Multi-cylinder Petrol Engine.
7. Retardation Test on a Diesel Engine.
8. Determination of Flash Point and Fire Point of various fuels / lubricants.

STEAM LAB

1. Study on Steam Generators and Turbines.
2. Performance and Energy Balance Test on a Steam Generator.
3. Performance and Energy Balance Test on Steam Turbine.

CE6315 STRENGTH OF MATERIALS LABORATORY

LIST OF EXPERIMENTS

1. Tension test on a mild steel rod
2. Double shear test on Mild steel and Aluminium rods
3. Torsion test on mild steel rod
4. Impact test on metal specimen
5. Hardness test on metals - Brinnell and Rockwell Hardness Number
6. Deflection test on beams
7. Compression test on helical springs
8. Strain Measurement using Rosette strain gauge
9. Effect of hardening- Improvement in hardness and impact resistance of steels.
10. Tempering- Improvement Mechanical properties Comparison
 - (i) Unhardened specimen
 - (ii) Quenched Specimen and
 - (iii) Quenched and tempered specimen.
11. Microscopic Examination of
 - (i) Hardened samples and
 - (ii) Hardened and tempered samples.
