VEER NARMAD SOUTH GUJARAT UNIVERSITY

B.E. Mechanic

Semester - IV

SYLLABUS OF FOURTH SEMESTER

Teaching Scheme			Theory Examinations		Practical / Term work / Sketching / Viva / Quiz			
Subject	**Subject Code**	**L T P (Hrs)**	**Duration (Hrs)**	**Marks**	**Tutorial**	**Cont. Evaluation**	**Exam. (Pract)**	**Total Marks**
Materials Science and Metallurgy	MED401MP	3 0 2	3	100	00	20	30	50
Electrical Technology	MED402MP	3 0 2	3	100	00	20	30	50
Mechanics of Solids-II	MED403MP	3 1 0	3	100	25	00	00	25
Engineering Mathematics-III	MED404MP	3 1 0	3	100	25	00	00	25
Thermodynamics-I	MED405MP	3 1 2	3	100	25	20	30	75
Fluid Mechanics	MED406MP	3 1 2	3	100	25	20	30	75
TOTAL		18 4 8		600	100	80	120	300
Total Contact Hours = 30			**Total Mark = 900**					

VEER NARMAD SOUTH GUJARAT UNIVERSITY

B.E. Mechanic

Semester - IV

MED 401 MP Material Science & Metallurgy			
	Lectures	**Tutorial**	**Practical**
Teaching Hours	3	-	2
Examination Scheme Marks	100	00	Continuous Evaluations 20 Examination 30

1. **STRUCTURE OF MATTER AND MECHANICAL BEHAVIOUR :** Electronic Configuration, Bonds, Co-ordination No., Lattice and Crystal Systems, Bragg's Law, X-Ray Diffraction Pattern, Crystal Imperfections, Mechanical Properties and Testing Including, Destructive and Non-destructive Testing of Materials.
2. **ELECTRONIC STRUCTURE OF SOLIDS :** Insulators, Semi Conductors, Super Conductors, Magnetic Properties and Thermal Conductivity. Problems related to the Electronic Structure of Solids.
3. **POLYMERS AND CERAMICS :** Polymerization, Molecular Weights, Properties of Polymers, Natural and Synthetic Rubbers, Unsaturated Polymers, Valcanization, Ceramics, Cermets and Composite Materials and their Properties and Engineering Applications.
4. **IRON MAKING AND STEEL MAKING :** Pig Iron Productions, Various Methods of Production of Steels including latest Steel making Processes. Sponge Iron Productions, Steels and Cast Irons. Study of some Important special Steels including H.S.S., Stainless Steels and Greep Resisting Steels, Tool Steels, etc..
5. **EQUILIBRIUM DIAGRAMS AND PHASE DIAGRAMS :** Binary Phase Diagram Systems, Construction and Importance of Phase Diagrams. Lever Rule and Phase Rule and their Applications. Eutectoid, Entectic, Peritectic, Peritectoid and Monotectic Systems. Some Non-ferrous systems and Alloys.
6. **HEAT TREAT AND POWER METALLURGY :** Heat Treating Processes, T.T.T. & C.C.T. Curves, Hardenability, Surface Hardening and Precipitation Hardening, Production of Metal Powders Compaction. sintering and Post Sintering Treatments, Production of Connected Tools, Bearings, Lamp Filaments, etc..

Term work will be based on the experiments pertaining to the topics mentioned in the syllabus.

REFERENCES :

1. Guy A.G., "Introduction to Material Science", International Students Edition.
2. Raghavan V., "Material Science Engineering", Prentice-Hall of India Private Limited, New Delhi, 1993.
3. Khurmi R.S., Sedha R.S., "Material Science", S.Chand & Co. Ltd., New Delhi, 1989.
4. Rajan T.V., Sharma C.P., Sharma Ashok, "Heat Treatment Principles and Techniques", Prentice-Hall of India Private Limited, New Delhi, 1988.

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B.E. Mechanic

Semester - IV

MED 402 MP Electrical Technology			
	Lectures	**Tutorial**	**Practical**
Teaching Hours	1	1	2
Examination Scheme Marks	100	25	Continuous Evaluations 20 Examination 30

1. **D.C. MACHINES :** Construction, Simple Lap and Wave Windings, Emf, Torque and Power Equations. Circuit model, Generating and Motoring models, Magnetizing Characterisics. Introduction to Armature Reaction and Commutation, Self excited Generators, Shunt, Series and Compound Motors. Speed Control, Efficiency and Losses.
2. **TRANSFORMERS :** Fundamentals and Construction of Single Phase and Three Phase Transformers, Ideal transformer, emf equation, No Load conditions, Loading, accounting for finite Permeability and Core Losses. Equivalent Circuit, no load and short circuit tests. per unit system, Voltage Regulation, Efficiency, Auto-Transformer, Three Phase transformers, Star and Delta Connections.
3. **SYNCHRONOUS MACHINES :** Construction and Basic Principles, Three Phase Windings, Rotating Magnetic Fields, Distribution and Pitch Factors, emf equation, Synchronous Speed, Armature Reaction, Synchronous Reactance, Voltage regulation, Synchronizing to mains, Damper Winding, Vector Diagrams for Generating and Motoring modes, Synchronous Motor Starting, V-Curves.
4. **INDUCTION MACHINES :** Construction and simple theory of Operation of Three Phase Induction Motor, Equivalent Circuit, Torque Speed Characteristics, No Load and Blocked Rotor tests, Load Test, Starting, Speed Control.
5. **FRACTIONAL KW MOTORS :** Brief Description of Reluctance Motors, Hysterisis Motor, Two Phase Servo Motor, Stepper Motors.

TERM WORK : Each Student shall Submit a Set of Drawing Sheets and Sketch Book Based on the above Syllabus.

REFERENCES :

1. Nagrath I.J., "Basic Electrical Engineering", T.M.H.

VEER NARMAD SOUTH GUJARAT UNIVERSITY
B.E. Mechanic
Semester - IV

MED 403 MP Mechanics of Solids - II			
	Lectures	**Tutorial**	**Practical**
Teaching Hours	3	1	-
Examination Scheme Marks	100	25	Continuous Evaluations 00 Examination 00

1. **ENERGY PRINCIPLES IN SOLID CONTINUUM :** Introduction to energy work and internal energy. Principles of virtual work- Betti's low and Maxwell's law, Principles of minimum potential energy, castiglianos, theorems – one & two, Principles of virtual complementary work, theorem of least work, problems based on above principles and theorems.
2. **THEORIES OF ELASTIC FAILURE :** The importance of failure theories in design, maximum normal strain, theory maximum shear stress theory, Max. axial strain theory, Energy distortion theory, applications.
3. **STRESSES CONCENTRATION AND TIME DEPENDENT PROPERTIES :** Stresses concentration and its importance in design, stress concentration factor combined stress caused by stress concentration Residual stress carried by stress concentration, Fatigue failure, S.N. diagram, endurance limit, effects of stress concentration or fatigue – creep and relaxation.
4. Strength of Joints and Fittings Strength of rivets, belts and pins, analysis of simple pin joints, Analysis of continuous joints effects of fatigue and stress concentration in joints, load distribution in rivetted and bolted joints, strength of rivet or belt, group strength of welds stress concentration and residual stress in welds, strength of belted joints.
5. **BENDING OF CURVED BARS :** Stresses in bars of small initial curvature, strength in bars of large initial curvature, Extension of curved bars, practical design application.
6. **ROTATING DISCS AND CYLINDER :** Stresses in uniform rotating discs, rotating discs of uniform strength , strength, stresses in rotating Cylinders.
7. **EXPERIMENTAL STRESS ANALYSIS :** Scopes of experimental stress analysis strain measurement devices, electrical resistance strain gauge, Basic principles, gauge factor, measurement circuits, applications to mechanical engineering problems.
8. Introduction to Plates & Shells Basic Principals of theory of elasticity, Def. of stress & strain , state of Str. At a point stress invarients. Generalised Hook's Law.

Assignment : A set of 15 problems based on course work
Practical : Nil

REFERENCES :

1. Mechanics of Solids – L.S. Srinath, Tata Mc Graw Hill, N. Delhi
2. Str. of Mt. Ryder ELBS Publi. , London
3. Advanced str. of Mat. – by Side Bottom & Boresi.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

B.E. Mechanic

Semester - IV

MED 404 MP Engineering Mathematics - III			
	Lectures	**Tutorial**	**Practical**
Teaching Hours	3	-	4
Examination Scheme Marks	100	00	Continuous Evaluations 40 Examination 60

1. **MULTIPLE INTEGRALS :**
   Reorientation of concept of integrals, Double and triple integrals, Evaluation techniques, Change of order of integration, Integrals in polar and cylindrical coordinates, Change of variables of multiple integrals, Application of double and triple integrals for evaluation of area, Volume and mass.
2. **VECTOR CALCULUS :**
   Basic concepts of vector calculus, Lines integrals, Scalar and vector point functions, Differential operatore, Gradient, Directional derivative, Divergence, Curl and Llplacial with their properties and physical interpretation. Surface integrals, Green's Gauss and Stokes theorem (Without Proof Applications.)
3. **BETA, GAMMA AND ERROR FUNCTIONS :**
   Improper integrals and their convergence, Beta and Gamma functions and their properties, Error functions Evaluation and application.
4. **FOURIER SERIES :**
   Fourier expansion of functions with arbitrary period in particular functions with period 2p , Conditions of convergence. Fourier series of even and odd functions, Half range fourier series.
5. **PARTIAL DIFFERENTIAL EQUATIONS (pde) :**
   Basic mathematical concepts, first order pde of Lagrange's form, pp + Qq =R, Second order pde of mathematical Physics (Heat, Wave and Laplace eq.) with standard boundary conditions, Solution by separation of variable method using Fourier Series, Partial differential equation Modelling.
6. **STATISTICS :**
   Reorientation of concept of measures of central tendency and variance. Probability distributions Binomial, Poisson's and Normal distributions. Tests of Hypothesis about the difference between two means, concerning Atributes, a population propertion. Small sampling theory, distribution, F and Z distribution with its properties and application.

REFERENCES :

1. E. Kreyszing, Advanced Engineering Mathematics, John Wiley International Students Ed. (1995)
2. C.R. Wylle, Advanced Engineering Mathematics, McGraw Hill, International Students Ed. (1993).
3. S.P. Gupta and M.P. Gupta, Business Statistics, S. Chand and Sons (1996).

VEER NARMAD SOUTH GUJARAT UNIVERSITY

B.E. Mechanic

Semester - IV

MED 405 MP Thermodynamics - I

	Lectures	Tutorial	Practical
Teaching Hours	3	1	2
Examination Scheme Marks	100	25	Continuous Evaluations 20 Examination 30

1. **BASIC CONCEPTS AND DEFINITIONS :** Macroscopic Vs Microscopic Point of View, Thermodynamic system and Control Volume, Thermodynamic Properties, States, Processes and Cycles, Thermodynamic Equilibrium, The Zeroth Law of Thermodynamics, Quasistatic Process, Temperature Scales, Units and Dimensions.
2. **PROPERTIES OF PURE SUBSTANCE :** The pure substance, Vapour-Liquid-Solid phase in a pure Substance, p-V-T Surace, Critical and Triple point of Pure Substance, Equation of State, Mollier Diagram, Steam tables, Dryness fraction of Steam, Thermodynamic Charts, (T-s, h-s etc.). Measurement of Quality of steam, Separating, Throttling Calorimeter.
3. **WORK AND HEAT :** Definition of work, Units of Work, Work Transfer, Work done in Various Processes, Definition of Heat, Specific Heat of a substance, Latent Heat of a Substance, Heat Transfer, Path Function, Comparison of Work and Heat.
4. **FIRST LAW OF THERMODYNAMICS :** The first law for a closed system undergoing a cycle and a change of state, Internal energy, Enthalpy, Specific heat at constant volume and Constant pressure, Control volume, Conservation of Mass and Energy, First Law of Thermodynamics for a Control Volume, Stead Flow Process. Variable Flow Processes. Application of first law of thermodynamics to Boilers, Engines, Turbines, Compressors.
5. **SECOND LAW OF THERMODYNAMICS :** Heat Engines and Refrigerators, Statements Of Second Law of Thermodynamics. The reversible process, Causes of Irreversibility, The Carnot Cycle, Carnot's Therorem, Corollary of Carnot's Theorem, Absolute Thermodynamic Temperature Scales, Reversed Carnot Cycle, Efficiency of Reversible Engine.
6. **ENTROPY :** Clausius Theorm, Inequality of Clausius Theorem. Entropy as a property, The entropy of a pure substance, Entropy change in reversible processes, Entropy change in Irreversible processes, Principle of Increase of Entropy, Entropy change of an Ideal Gas, Entropy change in polytropic precess, The Second Law of Thermodynamics for a Control volume, Second Law of Thermodynamics for Steady Flow Process, Principle of Increase of Entropy for a Control Volume, Entropy and Disorder, Absoluts Entropy.
7. **PROPERTIES OF GASES AND GAS MIXTURES :** Avogadro's Law, Equation of State of a Gas, Ideal Gas Equation, Specific Heats, Internal Energy and Enthalpy of Ideal Gas, Entropy change of an Ideal Gas In Various processes, Dalton's Law of Partial Pressures, Internal energy, Enthalpy, Specific Heat and Entropy of Gas Mixtures, Gibb's Function of a Mixture of Ideal Gases.
8. **FUELS AND LUBRICANTS :** Definition and Classification of Fuels, Composition and Calorific Value of Different fuels, Proximate and ultimate analysis of fuel. Types of lubricants, Requirements of Lubricant, Properties of Lubricant Properties of Lubricant fuel, Flash Point, Fire Point, Viscosity, Vapour, Pressure, Cloud Point, Pour Point etc..

REFERENCES :

1. Saad, M.A., "Engineering Thermodynamics", Prentics Hall, New Delhi, 1969.
2. Holman, J.P., "Thermodynamics", McGraw-Hill Book Co. N.Y. 1974.
3. Zeemansky, M.W. and Van Ness, H.C., "Basic Engineering Thermodynamics" John Wiley & Sons., Inc. N.Y. 1985.
4. Sharma S.P., "Fuels and Combustion".
5. Sears, F.W., "Thermodynamics", McGraw Hill, N.Y. 1960.
6. Ober t, E.F., "Concepts of Thermodynamics", McGraw-Hill, N.Y. 1960.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

B.E. Mechanic

Semester - IV

MED 406 MP Fluid Mechanics			
	Lectures	**Tutorial**	**Practical**
Teaching Hours	3	1	2
Examination Scheme Marks	100	25	Continuous Evaluations 20 Examination 30

1. **FLUID PROPERTICS :** Definition of Fluid, Viscosity, Kinematic Viscosity, Rheological Deagram, Fluid as Continum, Bulk Modulus of Elasticity, Compressibility, Classification of Fluids.
2. **FLUID STATICS :** Pressure at a Point, Forces on Plane Areas, Horizontal, Inclined and Vertical, Centre of Pressure, Forces on Curved Surfaces, Buogant Forces, Stability of Floating and Submerged Bodies, Relative Requilibrium, Under Linear Acceleration and Constant Rotation.
3. **DIMENSIONAL ANALYSIS :** Dimension, Different Systems, Dimensional, Homogenity, Theorem, Dimensional Grouping, Non-Dimensional Numbers, Geometrical, Kinematic and Dynamic Similarity.
4. **FLUID KINEMATICS :** Velocity Field, Steady, Insteady Flows-One, Two and Three Dimensional Flows, Streams Lines and Stream Tubes, Path Lines and Streak Lines. Enter and Lagrangian Methods, Substantial Derivative and Acceleration,Translation, Rotation and Deformations, Verticity and Rotational and Irrotational flows. Circulation, Stokes, Theorem, Virotational Flow, Velocity Potential. Equation of Continuity in Differential Form, Plane Two Dimensional Flow, Equation of Stream Line, Discharge in Terms of Stream Function, Stream Function and Velocityh Potential Function, Laplace Equation in Terms of Stream Function and Velocity Potential, Boundary Conditions, Flow Nets. Differential and Integral Approach Applied to Conservation of Mass, Momentum and Energy Principles, Control Volume, Transport Theorem, Laws of Control Volume Analysis.
5. **FLUID DYNAMICS :** Newton's Laws of Motion, Reynold's Transport Theorem, Euler's Eqn., Bernaulli's Equation Derived From Euler's Equation, Flow Through Confired Passages, Orifice, Nozzle, Venturi etc., Navior, Stokes Requirement, Application of Requirement of Continuity and Momentum to Simple Flows, Pipe-bends and Sudden Expansion.
6. **LAMINAR FLOW :** Concepts of Laminar and Tursulent Flows, Laminar Flow Through Round Pipes, Laminar Flow Between Parallel Plates, Both Moving and Stationary, Measurement of Viscosity.
7. **TURBULENT FLOW :** Through Pipes, Concept of Eddy Viscosity, Prandtle's Mixing Length Theory, Laminar Sublayer, Smooth and Rough Pipes, Nickwards Experiment, Moody's Chart.
8. **BOUNDARY LAYER THEORY :** Concept of Boundary Layer, Boundary Layer Over Flat Plates and Tubes, Boundary Layer Parameters, Boundary Layer Thickness, Momentum Thickness, Displacement Thickness, Von-Karman Momentum Integral Equation, Boundary Layer Separation and Control, Concept of Drag, Streamlined and Bluff Bodies.
9. **PIPE SYSTEMS :** Losses in Fittings, Power Transmission Through Pipes, Pipes Connected in Series and Parallel, Branched Pipes, Total Energy and Hydraulic Gradient Lines.

REFERENCES :

1. Sharma, I.H. : Mechanics of Fluid.
2. White I.M. : Fluid Mechanics, Tata McGraw Hill, New Delhi.
3. Sehadri C.V. and Patankar S.V. : Elements of Fluid Mechanics, Prentice Hall, New Delhi.

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B.E. Mechanic

Semester - IV

MED 402 MP Electrical Technology			
	Lectures	**Tutorial**	**Practical**
Teaching Hours	1	1	2
Examination Scheme Marks	100	25	Continuous Evaluations 20 Examination 30

6. **D.C. MACHINES :** Construction, Simple Lap and Wave Windings, Emf, Torque and Power Equations. Circuit model, Generating and Motoring models, Magnetizing Characterisics. Introduction to Armature Reaction and Commutation, Self excited Generators, Shunt, Series and Compound Motors. Speed Control, Efficiency and Losses.
7. **TRANSFORMERS :** Fundamentals and Construction of Single Phase and Three Phase Transformers, Ideal transformer, emf equation, No Load conditions, Loading, accounting for finite Permeability and Core Losses. Equivalent Circuit, no load and short circuit tests. per unit system, Voltage Regulation, Efficiency, Auto-Transformer, Three Phase transformers, Star and Delta Connections.
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B.E. Mechanic
Semester - IV

MED 403 MP Mechanics of Solids - II			
	Lectures	**Tutorial**	**Practical**
Teaching Hours	3	1	-
Examination Scheme Marks	100	25	Continuous Evaluations 00 Examination 00

9. **ENERGY PRINCIPLES IN SOLID CONTINUUM :** Introduction to energy work and internal energy. Principles of virtual work- Betti's low and Maxwell's law, Principles of minimum potential energy, castiglianos, theorems – one & two, Principles of virtual complementary work, theorem of least work, problems based on above principles and theorems.
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12. Strength of Joints and Fittings Strength of rivets, belts and pins, analysis of simple pin joints, Analysis of continuous joints effects of fatigue and stress concentration in joints, load distribution in rivetted and bolted joints, strength of rivet or belt, group strength of welds stress concentration and residual stress in welds, strength of belted joints.
13. **BENDING OF CURVED BARS :** Stresses in bars of small initial curvature, strength in bars of large initial curvature, Extension of curved bars, practical design application.
14. **ROTATING DISCS AND CYLINDER :** Stresses in uniform rotating discs, rotating discs of uniform strength , strength, stresses in rotating Cylinders.
15. **EXPERIMENTAL STRESS ANALYSIS :** Scopes of experimental stress analysis strain measurement devices, electrical resistance strain gauge, Basic principles, gauge factor, measurement circuits, applications to mechanical engineering problems.
16. Introduction to Plates & Shells Basic Principals of theory of elasticity, Def. of stress & strain , state of Str. At a point stress invarients. Generalised Hook's Law.

Assignment : A set of 15 problems based on course work
Practical : Nil

REFERENCES :

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