

SCHEME OF EXAMINATION w.e.f 2013-14  
B.TECH. 2<sup>nd</sup> Year Mechanical Engineering (Auto) -3<sup>rd</sup> Semester

S. No	Code	Subject Name	Teaching Schedule (Hrs)				Examination Schedule (Marks)			Total Marks	Duration of Exam
			L	T	P/D	Total	Sessional	Theory	Practical/ Viva-Voce		
1	HUM 201 E/ MATH-201E	Basics of Economics & Management / Mathematics-III	3	1	-	4	50	100	-	150	3
2	ME 201 E	Thermodynamics	3	1	-	4	50	100	-	150	3
3	ME 203 E	Strength of Materials-I	3	1	-	4	50	100	-	150	3
4	ME 205 E	Machine Drawing	2	-	4	6	50	100	-	150	4
5	ME 207 E	Kinematics of Machine	3	1	-	4	50	100	-	150	3
6	ME 209 E	Production Technology-1	3	1	-	4	50	100	-	150	3
7	ME 211 E	Kinematics of Machine Lab	-	-	3	3	50	-	50	100	3
8	ME 213 E	Thermodynamics Lab	-	-	3	3	50	-	25	75	3
9	ME 215 E	Strength of Materials Lab	-	-	3	3	50	-	25	75	3
	TOTAL		17	5	13	35	450	600	100	1150	--

**Note:** Students will be allowed to use Non-Programmable scientific calculator. However, sharing of calculator will not be permitted. Duration of theory as well as practical exams time is three hrs for all courses except ME-205E for which it is 4 hrs.

**B. Tech. (Third Semester) Mechanical Engineering(Auto)**  
**Basics of Economics & Management**  
**HUM 201 E**

L     T     P  
3     1     -

Sessional     : 50 Marks  
Theory         : 100 Marks  
Total           : 150 Marks  
Duration of Exam 3 Hrs.

**NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.**

**UNIT-I**

Meaning of Industrial Economics, production function, its types, least cost combination, law of variable proportions, law of returns: increasing, constant & diminishing.

Fixed & variable costs in short run & long run, opportunity costs, relation between AC & MC, U-shaped short run AC curve.

Price & output determination under monopoly in short run & long run, price discrimination, price determination under discrimination Monopoly, comparison between Monopoly & perfect competition.

**UNIT-II**

Meaning of management, characteristics of management, management Vs administration, management-Art, Science & Profession, Fayol's principles of management, Human relations approach, functions of management

**UNIT – III**

**Planning & organizing:** planning, steps in planning, planning premises, difference between planning policy & strategy, authority & responsibility, centralization & decentralization.

**UNIT – IV**

**Staffing, Directing & Controlling-**Manpower planning, recruitment & selection, styles of leadership, communication process and barriers, control process and steps in controlling.

**TEXT BOOKS:**

1. "Modern Economic Theory" Dewett, K.K., S. Chand & Co.
2. "Economic Analysis" K.P. Sundharam & E.N. Sundharam (Sultan Chand & Sons).
3. "Micro Economic Theory" M.L. Jhingan (Konark Publishers Pvt. Ltd.).
4. "Principles of Economics" M.L. Seth (Lakshmi Narain Aggarwal Educational Publishers – Agra).
5. "An Introduction to Sociology", D.R. Sachdeva & Vidya Bhusan.
6. "Society – An Introductory Analysis", R.M. Maclver Charles H. Page.
7. "Principles and Practices of Management : R.S. Gupta; B.D. Sharma; N.S. Bhalla; Kalyani.

**REFERENCE BOOKS**

1. "Organization and Management: R.D. Aggarwal, Tata McGraw Hill.
2. Business Organization and Management: M.C. Shukla

**B. Tech. (Third Semester) Mechanical Engineering Auto  
Mathematics-III**

**MATH 201 E**

L	T	P	Sessional	: 50 Marks
3	1	-	Theory	: 100 Marks
			Total	: 150 Marks
			Duration of Exam.	: 3 Hrs.

**NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.**

**UNIT – I**

Fourier series: Euler's Formulae, Conditions for Fourier expansions, Fourier expansion of functions having points of discontinuity, change of interval, Odd & even functions, Half-range series. Fourier Transforms: Fourier integrals, Fourier transforms, Fourier cosine and sine transforms. Properties of Fourier transforms, Convolution theorem, Parseval's identity, Relation between Fourier and Laplace transforms, Fourier transforms of the derivatives of a function, Application to boundary value problems.

**UNIT-II**

Functions of a Complex Variables: Functions of a complex variable, Exponential function, Trigonometric, Hyperbolic and Logarithmic functions, limit and continuity of a function, Differentiability and analyticity. Cauchy-Riemann equations, Necessary and sufficient conditions for a function to be analytic, Polar form of the Cauchy-Riemann equations, Harmonic functions, Application to flow problems, Conformal transformation, Standard transformations (Translation, Magnification & rotation, inversion & reflection, Bilinear).

**UNIT-III**

Probability Distributions : Probability, Baye's theorem, Discrete & Continuous probability distributions, Moment generating function, Probability generating function, Properties and applications of Binomial, Poisson and normal distributions.

**UNIT-IV**

Linear Programming : Linear programming problems formulation, Solution of Linear Programming Problem using Graphical method, Simplex Method, Dual-Simplex Method.

**Text Book:**

Higher Engg. Mathematics: B.S. Grewal  
Advanced Engg. Mathematics: E. Kreyzig

**References:**

1. Complex variables and Applications: R.V. Churchill; Mc. Graw Hill
2. Engg. Mathematics Vol. II: S.S. Sastry; Prentice Hall of India.
3. Operation Research: H.A. Taha

**B. Tech. (Third Semester) Mechanical Engineering (Auto)****Thermodynamics  
ME 201 E**

L	T	P	Sessional	:	50 Marks
3	1	-	Theory	:	100 Marks
			Total	:	150 Marks
			Duration of Exam.	:	3 hrs.

**NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.**

**Unit I**

Basic Concepts: Thermodynamics: Macroscopic and Microscopic Approach, Thermodynamic Systems, Surrounding and Boundary, Thermodynamic Property – Intensive and Extensive, Thermodynamic Equilibrium, State, Path, Process and Cycle, Quasi-static, Reversible and Irreversible Processes, Working Substance. Concept of Thermodynamic Work and Heat, Equality of Temperature, Zeroth Law of Thermodynamic and its utility.

Ideal and Real Gases: Concept of an Ideal Gas, Basic Gas Laws, Characteristic Gas Equation, Avagadro's law and Universal Gas Constant, P-V-T surface of an Ideal Gas. Vander Waal's Equation of state, Reduced Co-ordinates, Compressibility factor and law of corresponding states. Mixture of Gases, Mass, Mole and Volume Fraction, Gibson Dalton's law, Gas Constant and Specific Heats, Entropy for a mixture of Gases.

**Unit II**

First Law of Thermodynamics: Energy and its Forms, Energy and 1<sup>st</sup> law of Thermodynamics, Internal Energy and Enthalpy, 1<sup>st</sup> Law Applied to Non-Flow Process, Steady Flow Process and Transient Flow Process, Throttling Process and Free Expansion Process.

Second Law Of Thermodynamics: Limitations of First Law, Thermal Reservoir Heat Source and Heat Sink, Heat Engine, Refrigerator and Heat Pump, Kelvin- Planck and Clausius Statements and Their Equivalence, Perpetual Motion Machine of Second Kind. Carnot Cycle, Carnot Heat Engine and Carnot Heat Pump, Carnot's Theorem and its Corollaries, Thermodynamic Temperature Scale.

**Unit III**

Entropy: Clausius Inequality and Entropy, Principle of Entropy Increase, Temperature Entropy Plot, Entropy Change in Different Processes, Introduction to Third Law of Thermodynamics.

Availability, Irreversibility and Equilibrium: High and Low Grade Energy, Availability and Unavailable Energy, Loss of Available Energy Due to Heat Transfer Through a Finite Temperature Difference, Availability of a Non-Flow or Closed System, Availability of a Steady Flow System, Helmholtz and Gibb's Functions, Effectiveness and Irreversibility.

#### Unit IV

Pure Substance: Pure Substance and its Properties, Phase and Phase Transformation, Vaporization, Evaporation and Boiling, Saturated and Superheat Steam, Solid – Liquid – Vapour Equilibrium, T-V, P-V and P-T Plots During Steam Formation, Properties of Dry, Wet and Superheated Steam, Property Changes During Steam Processes, Temperature – Entropy (T-S) and Enthalpy – Entropy (H-S) Diagrams, Throttling and Measurement of Dryness Fraction of Steam.

Thermodynamic Relations: T-Ds Relations, Enthalpy and Internal Energy as a Function of Independent Variables, Specific Heat Capacity Relations, Clapeyron Equation, Maxwell Relations.

#### Text Books:

1. Engineering Thermodynamics – C P Arora, Tata McGraw Hill
2. Engineering Thermodynamics – P K Nag, Tata McGraw Hill

#### Reference Books :

1. Thermal Science and Engineering – D S Kumar, S K Kataria and Sons
2. Engineering Thermodynamics -Work and Heat transfer – G F C Rogers and Maghew Y R Longman

**B. Tech. (Third Semester) Mechanical Engineering (Auto)**  
**Strength of Materials –I**  
**ME 203 E**

L    T    P  
3    1    -

Sessional    : 50 Marks  
Theory        : 100 Marks  
Total         : 150 Marks  
Duration of Exam. : 3 Hrs.

**NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.**

**Unit I**

Simple stresses & strains : Concept & types of Stresses and strains, Polson's ratio, stresses and strain in simple and compound bars under axial loading, stress strain diagrams, Hooks law, elastic constants & their relationships, temperature stress & strain in simple & compound bars under axial loading, Numerical.

Compound stresses & strains: Concept of surface and volumetric strains, two dimensional stress system, conjugate shear stress at a point on a plane, principle stresses & strains and principal- planes, Mohr's circle of stresses, Numerical.

**Unit II**

Shear Force & Bending Moments : Definitions, SF & BM diagrams for cantilevers, simply supported beams with or without over-hang and calculation of maximum BM & SF and the point of contraflexure under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii) combination of concentrated loads and uniformly distributed loads, (iv) uniformly varying loads and (v) application of moments, relation between the rate of loading, the shear force and the bending moments, Problems.

Torsion of circular Members : Torsion of thin circular tube, Solid and hollow circular shafts, tapered shaft, stepped shaft & composite circular shafts, combined bending and torsion, equivalent torque, effect of end thrust. Numericals.

**Unit III**

Bending & shear Stresses in Beams: Bending stresses in beams with derivation & application to beams of circular, rectangular, I,T and channel sections, composite beams, shear stresses in beams with derivation combined bending torsion & axial loading of beams. Numericals.

Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Eulers formulae for the elastic buckling load, Eulers, Rankine, Gordom's formulae Johnson's empirical formula for axial loading columns and their applications, eccentric compression of a short strut of rectangular & circular sections, Numerical.

**Unit IV**

Slope & Deflection : Relationship between bending moment, slope & deflection, Mohr's theorem, moment area method, method of integration, Macaulay's method, calculations for slope and deflection of (i) cantilevers and (ii) simply supported beams with or without overhang under concentrated load, Uniformly distributed loads or combination of concentrated and uniformly distributed loads, Numerical.

Fixed Beams: Deflections, reactions and fixing moments with SF & BM calculations & diagrams for fixed beams under (I) concentrated loads, (ii) uniformly distributed load and (iii) a combination of concentrated loads & uniformly distributed load.

**Text Books:**

1. Strength of Materials – G.H.Ryder - Third Edition in S I units 1969 Macmillan India
2. Strength of Materials – Andrew Pytel and Fredinand L.Singer  
Fourth Edition, Int. Student Ed. Addison – Wesley Longman

**Reference Books :**

1. Strength of Materials – Popov, PHI, New Delhi.
2. Strength of Materials – Sadhu Singh, Khanna Publications
3. Strength of Materials A Rudimentary Approach – M.A. Jayaram, Revised Ed.2001,  
Sapna Book House, Bangalore
4. Strength of Materials – U.C.Jindal
5. Strength Materials – I. Kripal Singh

**B. Tech. (Third Semester) Mechanical Engineering (Auto)****Machine Drawing  
ME 205 E**

L	T	P	Sessional	: 50 Marks
2	-	4	Theory	: 100 Marks
			Total	: 150 Marks
			Duration of Exam	: 4 hrs.

**NOTE:**

- (1) In the semester examination, the examiner will set two questions from each unit. The students have to attempt three questions taking one from each unit.
- (2) The questions from Unit I and Unit II will carry 20 marks each. Question from Unit III will carry 60 marks.

**UNIT I**

Introduction to BIS Specification SP: 46 – 1988 Code of Engineering drawing – Limits, fits and Tolerance (Dimensional and Geometrical tolerance) , Surface finish representation.  
Gear: Gear terminology, I.S. convention , representation of assembly of spur gears, helical gears, bevel gears , worm and worm wheel.

**UNIT II**

Orthographic view from isometric views of machine parts / components. Dimensioning , Sectioning. Exercises on Coupling , Crankshaft , pulley , piston and Connecting rod , Cotter and Knuckle joint. Riveted Joint and Welded Joint.

**UNIT III**

Assembly drawing with sectioning and bill of materials from given detail drawings of assemblies : Lathe Tail stock , machine vice , pedestal bearing , Steam stop valve , drill jigs and milling fixture.

**Text Books:**

1. Machine Drawing by N D Bhat and V M Panchal, Charotar Publishing House
2. A Text Book of Machine Drawing : P S Gill , Pub.: S K Kataria & Sons

**Reference Books :**

1. A Text Book of Machine Drawing : Laxmi narayana and Mathur,  
Pub. : M/s. Jain Brothers, New Delhi.
2. Machine drawing :  
N Sidheshwar, P Kannaieh V V S Sastry  
Pub.: Tata Mc Graw –Hill Publishing Ltd.
3. Machine drawing :  
R B Gupta Satya Prakashan

**Note:** Some of the exercises may be done on AUTOCAD Software.



## B. Tech. (Third Semester) Mechanical Engineering (Auto)

### Kinematics of Machine

#### ME 207 E

L	T	P	Sessional	: 50 Marks
3	1		Theory	: 100 Marks
			Total	: 150 Marks
			Duration of Exam.	: 3 Hrs.

**NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.**

#### UNIT I

Kinematics, introduction to analysis and synthesis of mechanisms, Kinematics' pairs, Degree of freedom, Dynamic chain mechanism, Machine, Four-bar chain, inversions, Single and double slider crank chain, Quick return mechanisms, Introduction to function generation, Path generation and rigid bodied guidance.

Velocity determination; Relative velocity methods, Instantaneous center method Acceleration determination, Kennedy's Space cent rode and body cent rode,

#### UNIT II

Centripetal and tangential accelerations, Acceleration determination by graphical method using velocity polygons, Cariole's component of acceleration, Klein's and other constructions.

Analytical methods to find velocity and acceleration of four –link mechanism, slider crank mechanism, freumdenstein's equation, Coordinate a angular displacements of input and output links (Path generation function generation), Least square technique, Rigid body guidance.

#### UNIT III

Pantograph, straight-line motion mechanisms (Peculiar, Hart, Scott Russell, Grasshopper, Watt, Kemp's Tchybishev, Parallel linkages) Indicator mechanisms (Simplex Crosby , Thomson, etc ) Automobile steering gears (Davis and Ackerman), Hooks joint (universal coupling), Double hooks joints.

Types of friction, Laws of dry friction, Motion along inclined plane Screw threads, Wedge, Pivots and collars, Plate and cone clutches, Antifriction bearings, friction circle and friction axis, bearings and lubrication. Motion along inclined plane and screws, Pivots and Collars Thrust Bearings lubrication

#### UNIT IV

Types of cams and followers, various motions of the follower, Construction of cam profiles, Analysis for velocities and accelerations of tangent and circular arc cams with roller and flat –faced followers.

Open and crossed belt drives, velocity ratio, slip , material for belts, crowning of pulleys, law of belting, types of pulleys, length of belts ratio Of tensions, centrifugal tension, power transmitted by belts and ropes, initial tension, creep, chain drive, chain length, classification of chains

#### **Suggested reading:**

1. Theory of machines: S. S. Rattan, Tata McGraw Hill Publications
2. Theory of Mechanism and Machines: Jagdish Lal, Metropolitan Book Co.
3. Mechanism synthesis and analysis: A.H. Soni, McGraw Hill Publications.
4. Mechanism: J.S. Beggs.
5. Mechanics of Machines: P.Black, Pergamon Press.
6. Theory of Machines: P.L.Ballaney, Khanna Publisher.

**B. Tech. (Third semester) Mechanical Engineering (Auto)**  
**Production Technology-1**  
**ME 209 E**

L T P  
3 1 -

Sessional : 50 Marks  
Theory : 100 Marks  
Total : 150 Marks  
Duration of Exam. : 3 Hrs.

**NOTE: In the semester examination, the paper setter will set 8 questions in all, two questions from each unit, and students will be required to attempt only 5 questions, selecting at least one from each unit.**

**UNIT I**

**Metal cutting & Tool life**

Basic tool geometry, single point tool nomenclature, chips-various types and their characteristics, mechanism of chip formation, theoretical and experimental determination of shear angle, orthogonal and oblique metal cutting, metal cutting theories, relationship of velocities, forces and power consumption.

Effect of operating parameters life tool geometry, cutting speed, feed depth of cut, coolant, materials etc on forces temp. tool life, surface finish etc., tool life relationship, Taylor equation of tool life, tool material and mechanism.

**UNIT II**

**Economics of metal machining & Multi edged tools**

Element of machining cost, tooling economics, machines economics and optimization.

Broach tools-types materials and applications, geometry of twist drills, thrust torque and power calculation in drills, form tools-application.

**UNIT III**

**Metal forming & Jigs and Fixtures**

Metal blow condition, theories of plasticity conditions of plane strains, friction condition in metal working, wire drawing-extension of rods, theory of forging, rolling of metals and elementary rolling theory, no slip angle and forward slip.

Tool engineering, types of tools, usefulness, principles of location, locating and clamping devices, Jigs bushes, drilling Jigs, milling fixtures, turning fixtures, boring and broaching fixtures, different materials for Jigs and fixtures, economic of jigs and fixtures.

**UNIT IV**

**Metrology**

Measurements, linear and angular simple measuring instruments various clippers, screw gauge, sine bar, auto-collimator, comparator-mechanical, electrical, optical, surface finish and its measurement, micro and macro deviation, factors influencing surface finish and evaluation of surface finish.

**Suggested reading:**

1. Manufacturing science: Ghosh and Malik, E.W. Press
2. Principles of metal cutting: Sen and Bhattacharya, New Central Book.
3. Metal cutting principles: Shaw, MIT Press Cambridge
4. Manufacturing analysis: Cook, Addison-Wesley
5. Modern machining processes: Pandey and Shan, Tata McGraw Hill Publications

**B. Tech. (Third Semester) Mechanical Engineering (Auto)**  
**Kinematics of Machine Lab**  
**ME 211 E**

L      T      P  
 -      -      3

Sessional      : 50 Marks  
 Practical      : 50 Marks  
 Total            : 100Marks  
 Duration of Exam : 3 Hrs.

List of experiments

1. To determine the modulus of rigidity of the material of a closed coil helical spring and the stiffness of a spring
2. To determine the value of coefficient of friction for a given pair of surfaces using friction apparatus
3. To determine the modulus of rigidity of horizontal shaft
4. To determine experimentally the ratio of the cutting time to idle time (cutting stroke to idle stroke) of the crank and slotted lever (QRM)/ Whitworth and compare the result to theoretical values plot the following
  - a.  $\theta$  v/s X (displacement of slider).
  - b.  $\theta$  v/s velocity.
  - c.  $\theta$  v/s Acceleration and to compare the values of velocities  
 (Take angles  $\theta = 45^\circ, 90^\circ, 135^\circ, 225^\circ, 270^\circ$  &  $335^\circ$ ,  $\omega = 1$  rad/s)
5. To determine the value of coefficient of friction between the screw and nut of the jack, while:
  - a. Raising the load
  - b. Lowering the load
6. To draw experimentally a curve of the follower-displacement v/s cam-angle. Differentiate the above curve to get velocity and acceleration plot and compare the values with those obtained analytically.
7. To determine the coefficient of friction between belt and pulley and plot a graph between  $\log_{10} T_1/T_2$  v/s,  $\theta$ .
8. To determine the displacement, velocities, & accelerations of the driven shaft of a Hooke's joint for a constant speed of the driver shaft.
9. To determine velocity & acceleration of slider in slider-crank mechanism and plot the following:
  - a.  $\theta$  v/s x (displacement of slider)
  - b.  $\theta$  v/s velocity and
  - c.  $\theta$  v/s acceleration.

Compare the values of velocities & acceleration with those obtained theoretically. (Assume  $\omega = 1$  rad/sec.).
10. Study of the inversions of the single slider crank mechanism.
11. To verify the law of moment using Bell- crank lever.

**Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.**

**B. Tech. (Third Semester) Mechanical Engineering(Auto)****Thermodynamics Lab  
ME 213 E**

L	T	P	Sessional	: 50 Marks
-	-	3	Practical	: 25 Marks
			Total	: 75 Marks
			Duration of exam	: 3 Hrs.

**List of Experiments**

1. Study of 2 stroke petrol and diesel engine models.
2. Study of 4-stroke petrol/diesel engine model.
3. Study of boilers.
4. Study of Babcock-Wilcox boiler (Model).
5. Study of locomotive boiler (Model).
6. Study of Lancashire boiler (Model).
7. To study the Red wood viscometer and measure the viscosity of fluid.
8. To measure the flash point of the given fuel
9. To study the Nestler's boiler.
10. To study various parts of the vertical steam engine.
- 11 To study the diesel engine and make a trial on it.

**Note: Any 8 experiments from the above list and other 2 from others developed by institute) are required to be performed by students in the laboratory.**

**B. Tech. (Third Semester) Mechanical Engineering(Auto)**  
**Strength of Materials Lab**  
**ME 215 E**

L	T	P	Sessional	: 50 Marks
-	-	3	Practical	: 25 Marks
			Total	: 75 Marks
			Duration of Exam	: 3 Hrs.

**List of Experiments:**

1. To study the Brinell hardness testing machine & perform the Brinell hardness test.
2. To study the Rockwell hardness testing machine & perform the Rockwell hardness test.
3. To study the Vickers hardness testing machine & perform the Vickers hardness test.
4. To study the erichsen sheet metal testing machine & perform the erichsen sheet metal test.
5. To study the Impact testing machine and perform the Impact tests (Izod & Charpy).
6. To study the Universal testing machine and perform the tensile test.
7. To perform compression & bending tests on UTM.
8. To perform the shear test on UTM.
9. To study the torsion testing machine and perform the torsion test.
10. To draw shear Force, Bending Moment Diagrams for a simply Supported Beam under Point and Distributed Loads.
11. To determine Mechanical Advantage and Efficiency of Single and Double Purchase Winch Crab.
12. To determine Mechanical Advantage and Efficiency of Worm and Worm Wheel.
13. To determine Mechanical Advantage, Efficiency of Simple and Compound Screw Jack.
14. To find Moment of Inertia of a Fly Wheel.

**Note: Any 8 experiments from the above list and other 2 from others (developed by institute) are required to be performed by students in the laboratory.**