### BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA

#### 3rd SEMESTER

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<th>Code</th>
<th>Subject</th>
<th>L-T-P</th>
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<td>BSCM1205</td>
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<tr>
<td>HSSM3204</td>
<td>Engineering Economics &amp; Costing OR</td>
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<td>PCAT4201</td>
<td>Fluid Mechanics &amp; Machinery</td>
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<tr>
<td>PCME4203</td>
<td>Introduction to Physical Metallurgy &amp; Engg Materials</td>
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<td>PCAT4202</td>
<td>Automotive Thermodynamics</td>
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<td>PCME4202</td>
<td>Mechanics of Solids</td>
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**Credits (Theory)** 22

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<tr>
<td>PCME4203</td>
<td>Mechanical Engg. Lab (Applied Mechanics, FM &amp; Hy. Machines)</td>
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<td>PCME7201</td>
<td>Machine Drawing Laboratory *1-0-3</td>
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**Credits (Practicals / Sessionals)** 5

**TOTAL SEMESTER CREDITS** 27

#### 4th SEMESTER

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<tr>
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<td>Engineering Economics &amp; Costing OR</td>
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<tr>
<td>PCME4204</td>
<td>Kinematics &amp; Dynamics of Machines</td>
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<td>Automotive Engines</td>
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<td>PCME4206</td>
<td>Basic Manufacturing Processes</td>
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<td>Automotive Chasis</td>
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**Credits (Theory)** 21

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<td>PCAT7202</td>
<td>Auto Servicing &amp; Maintenance Lab</td>
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<td>Material Testing &amp; Fluid Power Laboratory</td>
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**Credits (Practicals / Sessionals)** 6

**TOTAL SEMESTER CREDITS** 27

**TOTAL CUMULATIVE CREDITS**

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* – There will be no University examination but internal examination at institute level for theory in Machine Drawing.
Module-I (18 hours)
Partial differential equation of first order, Linear partial differential equation, Non-linear partial differential equation, Homogenous and non-homogeneous partial differential equation with constant co-efficient, Cauchy type, Monge’s method, Second order partial differential equation
The vibrating string, the wave equation and its solution, the heat equation and its solution, Two dimensional wave equation and its solution, Laplace equation in polar, cylindrical and spherical coordinates, potential.

Module-II (12 hours)
Complex Analysis:
Analytic function, Cauchy-Riemann equations, Laplace equation, Conformal mapping,
Complex integration: Line integral in the complex plane, Cauchy’s integral theorem, Cauchy’s integral formula, Derivatives of analytic functions

Module –III (10 hours)
Power Series, Taylor’s series, Laurent’s series, Singularities and zeros, Residue integration method, evaluation of real integrals.

Text books:
   Reading Chapters: 11,12(except 12.10),13,14,15
   Reading chapter: 18

Reference books:
HSSM3204 **Engineering Economics & Costing**

**Module-I: (12 hours)**

**Module-II: (12 hours)**

**Module-III: (12 hours)**
Cost concepts, Elements of costs, Preparation of cost sheet, Segregation of costs into fixed and variable costs. Break-even analysis-Linear approach. (Simple numerical problems to be solved)
Banking: Meaning and functions of commercial banks; functions of Reserve Bank of India. Overview of Indian Financial system.

**Text Books:**

**Reference Books :**
4. Gupta, “ Managerial Economics”, TMH
5. Lal and Srivastav, “ Cost Accounting”, TMH
Module I:

Module II:

Module-III:

Text Books:

Reference Books:
1. Stephen P. Robbins, Organisational Behaviour, Prentice Hall of India
Fluid Mechanics and Machinery (3-1-0)

Module I
Introduction: Classification of fluids. Properties of fluids: viscosity, Newton’s laws of viscosity, surface tension, capillarity etc.
Fluid Statics: hydrostatic law, measurement of pressure with different manometers, Total pressure and Centre of pressure for Plane and curved surfaces, Buoyancy and stability of floating bodies, metacentric height .
Fluid Dynamics: Laws of kinematics of fluid flow. Lagrangian and Eulerian method. Convective and local acceleration, Stream line, Streak line and path line, concept of circulation and vorticity, Continuity equation in differential form, Stream function and potential functions with inter relations, concept of flow nets.

Module II
Energy equations: Bernoulli’s equations and its applications in pitot static tube, venturi meter, and orifice meter, energy correction factor, Momentum equation, Applications of momentum equations in pipe bends, impact of jets on moving and stationary ,plane and curved vanes, moment of momentum equations, force exerted on a series of radial curved vanes
Dimensional Analysis: Buckingham’s theorem, Non-dimensional numbers, similarities of flow. Model studies.
Laminar and Turbulent Flows: Reynolds experiments. Shear stress and velocity distribution for viscousflow through circular pipes and flat plates, Hagen Poiseullie’s equation, concept of boundary layer theory and separation of fluid flow, causes of turbulence, Characteristics of turbulent flow.
Flow through pipes: major and minor energy losses in pipes, pipes in series and parallel, equivalent cavitation, water hammer

Module III
Flow around submerged bodies: basic concept of lift and drag, coefficient of lift and drag.
Fluid Machinery: Pumps: Principles of operations and work done of centrifugal pumps, efficiencies, specific speed, net positive suction head, problems, Principles and working of gear, vane and reciprocating pumps.
Turbines: classification, Principles of operations and work done Pelton, Fransis and Kaplan, efficiencies, specific speed,

Text books:
1 R.K.Bansal,Fluid mechanics and Machinery, Laxmi Publications. 2005

References:
3 Modi and Seth: Fluid Mechanics and Hydraulic Machines, Standard Publications, New delhi
7 Domkundwar and Domkundwar, Fluid mechanics and Hydraulic Machines, Dhanpat Rai Publication.2006
PCME4203 **Introduction to Physical Metallurgy and Engineering Materials**

**MODULE-I** (16 Lectures)
Classification of Engineering Materials, Engineering properties of materials. Characteristic property of metals, bonding in solids, primary bonds like ionic, covalent and metallic bond, crystal systems, common crystal structure of metals, representations of planes and directions in crystals, atomic packing in crystals, calculation of packing density, voids in common crystal structures and imperfections crystals. Concept of plastic deformation of metals, critical resolve shear stress, dislocation theory, deformation by slip and twin, plastic deformation in polycrystalline metals, yield point phenomenon and related effects, concept of cold working preferred orientation. Annealing ; recovery; recrystalization and grain growth; hot working.

**MODULE-II** (16 Lectures)
Concept of alloy formation, types of alloys, solid solutions, factors governing solids solubility viz. size factor, valency factor, crystal structure factor and chemical affinity factor; order-disorder transformation. Binary phase diagrams a) Isomorphism system, (b) Eutectic system, (c) Peritectic system, (d)Eutectoid system and (e) Peritectoid system. Allostropic transformation. Lever rule and its application, Interpretation of solidification behaviors and microstructure of different alloys belonging to those systems, Effect of non-equilibrium cooling, coring and homogenization. Iron-cementite and iron-graphite phase diagrams, microstructure and properties of different alloys (alloy steels; stainless steel, tool steel, HSS, high strength low alloy steel) types of cast iron, their microstructures and typical uses. Specification of steel.

T.T.T. diagram: concept of heat treatment of steels i.e. annealing, normalizing, hardening and tempering; microstructural effects brought about by these processes and their influences on mechanical properties; factor affecting hardenability.

**MODULE-III** (12 Lectures)

Ceramics: Types, structure, Mechanical properties, application


**Text Books:**
1. Engineering Physical Metallurgy and Heat Treatment by Y.Lakhtin, Mir Publisher, Moscow.
2. Introduction to Physical Metallurgy by Avner, Tata McGraw Hill

**Reference Books**
1. Elements of Material Science and Engineering, L.H.Van Vlack, Addison Wesley
2. Physical Metallurgy: Principles and Practice by Ragahvan, PHI
3. The Science & Engg of Materials by Donald R. Askeland & Pradeep P Phule, Thomson Learning (India Ed)
5. Essentials of Material Sc. & Engineering by Donald R. Askeland and Pradeep P Phule, Thomson Learning
6. Processes and Material of manufacture by Lindberg, PHI.
7. Elements of Materials Science & Engineering by Van Vlack, Pearson
8. Mechanical Metallurgy by Dieter, Tata MacGraw Hill
9. Materials Science and Metallurgy By Daniel Yesudian, Scitech
10. Material Science and Metallurgy by C.K.Dutta, Dhanpat Rai
11. Materials Science and Metallurgy by R.B.Choudhary, Khanna Publishers
15. Materials Science by M.S. Vijaya , G.Rangarajan, TMH
16. Materials Science by V. Rajendra, A. Marikani, , TMH
AUTOMOTIVE THERMODYNAMICS (3-1-0)

Module-I (13 Hours)

Module-II (15 Hours)
3. Fuels and Combustion:
   Fuels: solid, liquid and gaseous, Chemical equations – conservation of mass, lst law applied to combustion process, calorific value of the fuel, calorific value of fuels, efficiency of combustion processes, limitations of thermodynamic analysis. Alternative fuels for automobiles
4. Refrigeration and air conditioning
   Principles of refrigeration, Vapour compression and vapour absorption system, COP, properties of refrigeration, Psychometric, Type of air conditioning system.

Module-III (12 Hours)
5. Basics of Gas dynamics and Isentropic flow through Nozzles
6. Air Compressors:
   Introduction (Uses of compressed air), The reciprocating cycle neglecting and considering clearance volume, Volumetric efficiency and its effect on compressor performance, Limitations of single stage compression, Multistage compression and intercooling, Optimum intercooler pressure, Performance and design calculations of reciprocating compressors, Air motors.
   Centrifugal and axial flow compressor, blowers and fans: Components, working principles and applications.

Text Books
1. Basic and Applied thermodynamics, P.k.Nag, TMH publications
2. Fundamentals of Engineering Thermodynamics, E. Rathakrishnan (PHI)

Reference
4. A course in Thermodynamic and Heat Engine: Kothandaraman and Domkundwar, Dhanpat Rai publication
5. Applied Thermodynamics: P.L.Balany, Khanna publications
PCME4202 Mechanics of Solids

MODULE - I (14 Lectures)
1. Load, Stress, Principle of St.Venant, Principle of Superposition, Strain, Hooke’s law, Modulus of Elasticity, Stress-Strain Diagrams, Working Stress, Factor of safety, Strain energy in tension and compression, Resilience, Impact loads, Analysis of Axially Loaded Members: Composite bars in tension and compression - temperature stresses in composite rods, Statically indeterminate problems. Shear stress, Complimentary shear stress, Shear strain, Modulus of rigidity, Poisson’s ratio, Bulk Modulus, Relationship between elastic constants.
2. Members in Biaxial State of Stress: Stresses in thin cylinders, thin spherical shells under internal pressure - wire winding of thin cylinders. Analysis of Biaxial Stress. Plane stress, Principal stress, Principal plane, Mohr’s Circle for Biaxial Stress.
3. Strain Deformation: Two dimensional state of strain, Mohr’s circle for strain, Principal strains and principal axes of strain measurements, Calculation of principal stresses from principal strains.

MODULE - II (13 Lectures)
5. Simple Bending of Beams: Theory of simple bending of initially straight beams, Bending stresses, Shear stresses in bending, Distribution of normal and shear stress, beams of two materials, Composite beams.
6. Deflection of Beams: Differential equation of the elastic line, Slope and deflection of beams by integration method and area - moment method.

MODULE - III (12 Lectures)
7. Theory of Columns: Eccentric loading of a short strut, Long columns, Euler’s column formula, Lateral buckling, Critical Load, Slenderness ratio
8. Torsion in solid and hollow circular shafts, Twisting moment, Strain energy in shear and torsion, strength of solid and hollow circular shafts. Stresses due to combined bending and torsion, Strength of shafts in combined bending and twisting.

TEXT BOOKS
3. Strength of Materials by James M. Gere and Barry J. Goodno, Cengage Learning

REFERENCE BOOKS
7. Strength of Materials by R.Subramaniam, Oxford University Press
Sessional/Practical

Mechanical Engineering Laboratory (0-0-3) Credits: 02

Applied Mechanics Lab.

1. Determination of Moment of Inertia of Flywheel,
2. Determination of velocity ratio and efficiency of Screw jack
3. Determination of velocity ratio and efficiency of winch crab
4. Deflection of beam

Fluid Mechanics Lab

1. Determination of met centric height
2. Verification of Bernoulli’s Theorem
3. Determination of CD and CV of Venturimeter and Orifice meter
4. Determination of coefficient of friction for flow through pipes

Measurement of Basic Parameters

1. Measurement of Pressure (Manometer, Pressure gauge)
2. Measurement of Temperature (Thermocouples and resistance thermometer)
3. Measurement of Fluid Flow (Rotameter, turbine flow meter)
4. Measurement of Velocity (Orificemeter)
5. Measurement of Speed (contact and non-contact type)

N.B.: Total experiments to be conducted 12 and minimum 3 experiments form each group.
Machine Drawing (1-0-3)  Credits: 03

Orthographic and Sectional drawing of Machine components: (Any seven)
Screw threads, Screwed fastenings, Turn Buckle, Keys, Cotter joints and Knuckle joints; Pulley;
Flanged coupling, Pedestal Bearing or Plummer Block, connecting rod, Piston and piston assembly and valves.

Fundamentals of AutoCAD (Two classes)
1. Dimension & annotations
2. Use of Layers
3. Working with constraint in dimension
4. Creating assembly
5. Axi-symmetrical parts
6. Creating surface features
7. Working with bill of material

Drawing of the following using AUTOCAD: (Any two)
1. Projection of solids
2. Nut & bolt and Fasteners
3. Cotter joint
4. Expansion joint
5. Shaft coupling

Text Books:

Reference Books:
3. Engineering Drawing by N.D. Bhatt, Charotar
4. Engineering Drawing and Graphics + AutoCAD by K. Venugopal, New Age International
Module-I (20 hours)
**Numerical methods:**
Approximation and round of errors, Truncation error and Taylor’s series
Roots of equation: The bisection method, the false-position method, fixed point iteration, the Newton-Raphson method, Muller’s method
Linear algebraic equation: LU decomposition, the matrix inverse, Gauss-Seidel method
Interpolation: Newton divided difference interpolation, Lagrange Interpolation, Newton’s forward and backward interpolation.
Numerical integration: The trapezoidal rule, The Simpson’s rules, Gauss quadrature
Ordinary differential equation: Euler’s method, Improvement of Euler’s method, Runge-Kutta methods

Module-II (10 Hours)
**Probability:**
Probability, Random variables, Probability distributions, Mean and variance of distribution, Binomial, Poisson and Hypergeometric distributions, Normal distribution, Distribution of several random variables.

Module-III (10 Hours)
**Mathematical Statistics:**
Random sampling, Estimation of Parameters, Confidence Intervals, Testing of hypothesis, Acceptance sampling, Chi square test for goodness of fit , Regression Analysis, Fitting Straight Lines, Correlation analysis.

**Text books:**


**Reference books:**

Module - I (13 Lectures)
1. Mechanisms: Basic Kinematic concepts and definitions, Mechanism, Link, Kinematic Pair, Classification of kinematic pairs, Degrees of freedom, Kinematic chain, Binary Ternary and Quaternary joints and links, Degrees of freedom for plane mechanism, Gruebler’s criterion, Inversion of mechanism, Four bar chains and their inversions, Single slider crank chain, Double slider crank chain and their inversion.

Module - III (14 Lectures)
3. Inertia forces in reciprocating Parts: Velocity and acceleration of piston by analytical method, Angular velocity and angular acceleration of connecting rod by analytical method and by graphical method, Piston effort, force acting along the connecting rod, Crank effort, Turning moment on crank - shaft.
4. Dynamically equivalent system, compound Pendulum, correction couple. Turning moment diagrams for different types of engines, Fluctuation of energy and fluctuation of speed.
5. Friction of a screw and nut, Square threaded screw, V-threaded screw, Pivot and collar friction, friction circle, Friction axis, Friction clutches, Transmission of power by single plate, multiplate and cone clutches.

Module - III (13 Lectures)
8. Belt, rope and chain drives, Initial tension, Effect of centrifugal tension on power transmission, Maximum power transmission capacity, Belt creep and slip.

Text Books
1. Theory of Machines by Thomas Bevan, CBS Publications
2. Theory of Machines by S.S.Rattan, Tata MacGraw Hill

Reference
1. Kinematics and Dynamics of Machinery by Charles E. Wilson and J.Peter Saddler, Pearson Ed.
Module I

Introduction and Fuel supply systems: - 12 hours
Classification of I.C Engines, two stroke petrol and diesel engines construction, working and port timing diagrams, four stroke petrol and diesel engines-construction, working and valve timing diagram, comparison of two stroke and four stroke engines, differences between petrol and diesel engines, firing order, fuel supply system for SI engines-carburettors(simple and solex), fuel supply system for CI engines- fuel filter, fuel pump and injector, calculation of air fuel ratio for petrol and diesel, air fuel ratio for modern automotive vehicles.

Module II

Lubrication, cooling systems and performance: - 14 hours
Function of lubrication systems, types of lubrication systems- mist, wet and dry sump lubrication systems, properties and designation of lubricants. Need for cooling systems-air and liquid cooling systems-properties of coolants, cooling agents. Performance tests in IC engines and heat balances.

Module III

Combustion and Power boosters: - 14 hours
Phenomenon of combustion in SI engines, stages of combustion, flame propagation, rate of pressure rise, abnormal combustion, effect of engine variables on knocking, fuel quality for SI engines, octane rating, combustion chambers for SI engines. Phenomenon of combustion in CI engines, stages of combustion, ignition delay, factors affecting delay period, knock in CI engines, comparison of knock in SI and CI engines, direct and indirect injection diesel engines, combustion chambers, supercharging and turbo-charging methods.

Text Books:

Reference books:
1. Heywood, Internal Combustion Engines
Module - I (12 Lectures)
1. Foundry :
   (a) Types of patterns, pattern materials and pattern allowances.
   (b) Molding Materials - sand molding, metal molding, investment molding, shell molding.
   (c) Composition of molding sand, Silica sand, Zircon sand, binders, additives, Binders - clay, binders for CO$_2$ sand, binder for shell molding, binders for core sand.
   (d) Properties of molding sand and sand testing.
   (e) Melting furnaces - cupola, resistance furnace, induction and arc furnace.
   (f) Solidification of castings, design of risers and runners, feeding distance, centre line freezing resistance chills and chaplets.
   (g) Degasification and inoculation of metals.
   (h) Casting methods like continuous casting, centrifugal casting, disc casting.
   (i) Casting defects.

Module – II (12 Lectures)
Brazing and soldering, welding defects.
Destructive and non-destructive testing of castings and welding.
3. Brief introduction to powder metallurgy processes.

Module – III (14 Lectures)
5. Rolling: Pressure and Forces in rolling, types of rolling mills, Rolling defects.
8. Wire drawing methods and variables in wire-drawing, Optimum dies shape for extrusion and drawing.
10. Brief introduction to explosive forming, coating and deposition methods.

Text Books
2. Welding Technology by R.A. Little, TMH
3. Manufacturing Science by A.Ghosh and A K Malick, EWP

Reference Books
1. Fundamentals of metal casting technology by P.C. Mukherjee, Oxford PIBI.
2. Mechanical Metallurgy by Dieter, Mc-Graw Hill
3. Processes and Materials of Manufacture by R.A Lindberg, Prentice hall (India)
4. A Text Book of Production Engineering by P.C.Sharma, S.Chand
Module I

Frames, front axle and steering systems: - 12 hours
Types of frames, unitised frame body construction- loads acting on frames, types of front axle, construction details and materials, front wheel geometry i.e. camber, castor, king pin inclination, toe-in and toe-out. Condition for true rolling motion. Steering geometry. Ackerman and Davis steering system constructional details of steering linkages and layouts. Different types of steering gear levers-construction and operation, power and power assisted steering.

Module II

Driveline, rear axles and final drive: - 12 hours
Effect of driving thrust and torque reaction, Hotchkiss drive, torque tube drive. Propeller shaft, universal joint, constant velocity joint and front wheel drive. Construction of rear axles. Types of load acting on axles. Full floating, three-quarter floating and semi-floating rear axles construction of different rear axle housing.
Different types of final drives such as straight bevel gear, spiral bevel gear and hypoid gear. Differential principle and operation construction of differential. Differential locks.

Module III

Suspension System and Braking System: - 12 hours
Need of suspension system, types of suspension construction details of suspension springs such as leaf springs. Coil springs and torsion bar springs. Shock absorbers-telescopic type shock absorber. Independent suspension system. Introduction to rubber and pneumatic suspension system.
Classification of brakes- drum and disc brakes. Different types of breaking system as mechanical, hydraulic, cylinder and pneumatic breaking system. Master cylinder, tandem master cylinder and wheel power and power assisted brakes. Anti-locking braking systems.

Text Books

References
PCAT 7201 BASIC MANUFACTURING PROCESS LAB (0-0-3)

FOUNDRY AND CASTING  
Pattern making, pattern material, pattern allowances, types of pattern, moulding tools, green sand moulding, gating, riser and core. Any two moulds to be given as exercises (solid with core, flange, gear). Casting demonstrations.

LATHE  
Parts of a lathe, exercise on facing, turning, step turning, taper turning, threading, knurling.

BASIC EXERCISES ON ANY THREE OF THE FOLLOWING MACHINES  
1. Shaper - Cube and V Block.  
2. Drilling - Drilling and Tapping.  
4. Grinding - Surface grinding on a plate.  
5. Slotting - Making a rectangular slot.

PCAT 7202 AUTO SERVICING & MAINTENANCE LAB (0-0-3)

1. Study of various types of 2 – stroke SI Engines.  
2. Study of various types of 4 – stroke SI Engines.  
3. Study of various types of 4 – stroke CI Engines.  
7. Dismantling and assembly of sliding mesh & constant mesh gear boxes.  
10. Study of manual / power assisted steering system & drawing of layout.  
11. Cylinder reboring – checking of cylinder bore, setting the cool & reboring.  
12. Minor & Major tune-up of gasoline & diesel engines.  
13. Study and checking of wheel geometry – camber, caster, king-pin inclination & toe-in.

Note: Any “Ten” experiments have to be carried out.
A) MATERIAL TESTING LAB (ANY FIVE OF SEVEN)
1. Tension Test
2. Torsion Test
3. Testing of springs
4. Impact Test (a) Izod (b) Charpy
5. Hardness Test (a)Vicker's (b)Brinell (c) Rockwell
6. Deflection of beam
7. Dye Penetrant Test

B) Fluid Power Laboratory
1. Determination of performance characteristics of centrifugal pump, gear pump, reciprocating pump (any two)
2. Determination of performance characteristics of reaction and impulse turbine (any one)
3. Determination of volumetric efficiency of a reciprocating air compressor

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BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ORISSA
Automobile Engineering

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<td>Vehicle Body Engineering</td>
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<td>Two and Three Wheelers</td>
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**Credits (Theory)**: 18  
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**Credits (Practicals / Sessionals)**: 6  
**Credits (Practicals / Sessionals)**: 6

**TOTAL SEMESTER CREDITS**: 24  
**TOTAL CUMULATIVE CREDITS**:

**TOTAL SEMESTER CREDITS**: 24  
**TOTAL CUMULATIVE CREDITS**:

Module I: Functions of Management  
12Hr
Concept of management, Management as an Art or Science, Process of management, Managerial skills, Good Managers are born, not made, Management is concerned with ideas, Things and People, How a Manager induces workers to put in their best, Levels and types of management, Evolution of management thought: Managerial environment, The process of management-planning, organizing, directing, staffing, controlling.

Module II: Marketing Function of Management.  
12Hr
Modern concept of marketing, the functional classification of marketing, functions of a marketing management, marketing mix, fundamental needs of customers, the role of distribution channels in marketing, advertising, marketing, consumerism and environmentalism.

12Hr
Financial functions, concept of financial management, project appraisal, tools of financial decisions making, overview of working capital. 
HRM Function of Management: Human resource management, human resource development, importance of HRM, overview of job analysis, job description, job specification, labour turnover. Manpower planning, recruitment, selection, induction, training and development, placement, wage and salary administration, performance appraisal, grievance handling, welfare aspects.

Reference Books:
2. Business Organization & Management, Tulsia, Pandey, Pearson
3. Marketing Management, Kotler, Keller, Koshi, Jha, Pearson
4. Financial Management, I.M. Pandey, Vikas
5. Human Resource Management, Aswasthapa, TMH.
DESIGN OF MACHINE COMPONENT

OBJECTIVE:

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components

Module- I  INTRODUCTION  12


Threaded fasteners - Design of bolted joints including eccentric loading – theory of bonded joints. (Riveted joints - self study)

Module- II  DESIGN OF SHAFTS AND BEARING  12

Introduction – Fit and tolerance- Material and design stresses –Design of shafts on the basis of strength – Design of shaft on the basis of rigidity – Design of hollow shafts.

Types of Bearings- Design of journal bearings - Ball and Roller bearings – Types of Roller bearings – Bearing life – Static load capacity – Dynamic load capacity – Bearing material – Boundary lubrication – Oil flow and temperature rise.

Module- III  SPRINGS AND FLYWHEELS  12

Design of close coiled helical spring subjected to axial loading – Torsion of helical springs.

Determination of the mass of a flywheel for a given co-efficient of speed fluctuation. Engine flywheels stresses of rim of flywheels. Design of hubs and arms of flywheel – Turning moment diagram.

TOTAL : 36 PERIODS

TEXTBOOKS:
AUTOMOTIVE TRANSMISSION SYSTEMS

MODULE I

Mechanical and Hydrodynamic Drive 12 Hours
Requirement of transmission system. Different types of clutch, principle, Construction, torque capacity and design aspects. Different types of gear boxes – Sliding, Constant and Synchromesh gearbox.


MODULE II

Automatic transmission and Application 12 Hours
Ford-T-model gear box, Wilson Gear box, Cotal electromagnetic transmission, Hydraulic control system for automatic transmission and Chevrolet “Turboglide” Transmission system

MODULE III

Hydrostatic Drive and Electric Drive 12 Hours
Hydrostatic drive: Various types of hydrostatic systems – Principles of hydrostatic drive system, Advantages and limitations, Comparison of hydrostatic drive with hydrodynamic drive, construction and working of typical Janny hydrostatic drive.

REFERENCES
4. SAE Transactions 900550 & 930910.
Module – I (12 hours)
3. Toothed gears : Gear terminology, law of gearing , Theory of shape and action of tooth properties and methods of generation of standard tooth profiles, Standard proportions, Path of contact, Arc of contact, Contact ratio, Interference and Under – Cutting, Methods for eliminating Interference, Minimum number of teeth to avoid interference.

Module II (12 hours)

Module III (12 hours)

Text Books
1. Theory of Machines by Thomas Bevan, CBS Publications
2. Theory of Machines by S.S.Rattan, Tata MacGraw Hill

Reference
6. Theory of Mechanisms and Machines by C.S.Sharma and K.Purohit, PHI
8. Theory of Machines by Shah Jadwani, Dhanpat Rai
TWO AND THREE WHEELERS

MODULE I

The Power Unit

MODULE II

CHASSIS AND SUB-SYSTEMS
Main frame, its types. Chassis and shaft drive. Single, multiple plates and centrifugal clutches. Gear box and gear controls. Front and rear suspension systems. Shock absorbers. Panel meters and controls on handle bar.

Drum brakes, Disc brakes, Front and rear brake links lay-outs. Spoked wheel, cast wheel. Disc wheel, Disc types, Tyres and tubes.

MODULE III

Two Wheelers

Three Wheelers
Case study of Indian models. Front engine and Rear engine. Auto rickshaws. Pick up van. Delivery van and Trailer.

TEXT

REFERENCE:
AUTOMOTIVE TEST INSTRUMENTATION

Module- I | MEASUREMENT SYSTEMS | 12
Static and Dynamic Measurement systems- Requirements and characteristics – Analysis of experimental detail.

Transducers for Automotive Applications – Amplifiers- filters –data Acquisition- Indicators, Printers and displays –Signal Analyzing.

Module- II | ENGINE EXPERIMENTAL TECHNIQUES | 12

Module- III | VEHICLE EXPERIMENTAL TECHNIQUES | 12

TOTAL : 36 PERIODS

REFERENCES:
1. A.W. JUDGE, Engineering Precision Measurement, Chapman and Hall Ltd, Essex Street W.C.,1951,
2. T.G. Beckwith and Buck, Mechanical Measurements, Oxford and IBH Publishing House, New Delhi, 1995
ADVANCED PRODUCTION PROCESSES FOR AUTOMOTIVE COMPONENTS

Module- I  FORMING PROCESS  12

Module- II  GEAR MANUFACTURING & POWDER METALLURGY  12


Module- III  RECENT TRENDS IN MANUFACTURING OF AUTO COMPONENTS  12


TOTAL: 36 PERIODS

TEXT BOOK

REFERENCES
Module –1 10 lectures
Elements of a general measurement system;
Static Characteristics: systematic characteristics, statistical characteristics, calibration;
Dynamic characteristics of measurement systems: transfer functions of typical sensing
elements, step and frequency response of first and second order elements, dynamic error in
measurement systems. (Bentley: Chapters 1-4)

Module-2 14 lectures
Sensing elements: Resistive sensing elements: potentiometers, Resistance Temperature
Detector (RTD), thermistors, strain gages.
Capacitive sensing elements: variable separation, area and dielectric;
Inductive sensing elements: variable reluctance and LVDT displacement sensors;
Electromagnetic sensing elements: velocity sensors,
Thermoelectric sensing elements: laws, thermocouple characteristics, installation problems,
cold junction compensation.
IC temperature sensor
Elastic sensing elements: Bourdon tube, bellows, and diaphragms for pressure sensing, force
and torque measurement.
(Bentley: Sections 8.1 to 8.6; Ghosh: Section 10.3 to 10.4).

Module-3 10 lectures
Signal Conditioning Elements:
Deflection bridges: design of resistive and reactive bridges, push-pull configuration for
improvement of linearity and sensitivity
Amplifiers: Operational amplifiers-ideal and non-ideal performances, inverting, non-inverting
and differential amplifiers, instrumentation amplifier, filters. A.C. carrier systems, phase
sensitive demodulators and its applications in instrumentation.
(Bentley: Sections 9.1 to 9.3; Ghosh: Sections 15.1 and 15.2).

Text Books:

Reference Books:
2. Instrumentation for Engineering Measurements - J.W. Dally, W.F. Riley and K.G. McConnel 
Module I (11 hour)
Fundamentals of CAD: Design process, Applications of computer for design, Creating the Manufacturing Database, The Design workstation, Graphical Terminal, Operator input Devices, Plotters and other devices, Central Processing Unit, Memory types.

Module II (11 hour)
Computer graphics Software and Database: Configuration, Graphics Packages, Constructing the Geometry, Transformations of geometry, Database structure and content, Wire frame versus solid modeling, Constraint– Based modeling, Geometric commands, Display control commands, Editing.

Module III (14 hour)

Text Books

Reference Books
1. CAD/CAM Theory and Practice, Zeid and Subramanian, TMH
2. CAD/CAM Principles, Practice and Manufacturing Management, McMahon and Browne, Pearson Education
3. CAD/CAM Concepts and Applications, C.R.Alavala, PHI
5. CAD/CAM Theory and Concepts, K.Sareen and C.Grewal, S.Chand Publication
6. CAD/CAM/CAE, N.K.Chougule, Scitech
Module-I: (10 Hours)
Organization of Microprocessor
Introduction to the general concept of microprocessor organization, I/O sub-systems, programming the system, ALU, instruction execution, instruction word format, addressing modes, address/data/control bus, tristate bus, interfacing I/O devices, data transfer schemes, architectural advancements of microprocessor, evolution of microprocessors.

Module-II: (12 Hours)
Intel 8086- Hardware Architecture:
Introduction, Bus interface unit(BIU), Execution unit(EU), pin description, register organization, instruction pointer, data register, pointer and index registers, status register, stack, external memory addressing, bus cycle (minimum mode):memory or I/O read/write for minimum mode, clock generator Intel- 8284A, bidirectional bus trans-receiver 8286/8287, bus controller 8288, bus cycle memory read/write for minimum mode, 8086 system configuration (minimum mode as well as maximum mode), memory interfacing, interrupt processing; software interrupts, single step interrupt, non-maskable interrupt, maskable interrupt, interrupt priority, DMA, Halt State, Wait for Test state, comparison between 8086 an 8088.

Module-III: (13 Hours)
Instruction set and programming:
Programmer's model of Intel 8086, operand type, addressing modes 8086 assembler directives, instruction set, programming examples on data transfer group, arithmetic-logical groups, control transfer groups (loop and loop handling instruction), conditional and unconditional group, procedures and stack operations, string instructions, branch program structure like IF-THEN-ELSE REPEAT-UNTIL and WHILE-DO, I/O Interfacing;
8-bit input- output port 8255 PPI, memory mapped i/o ports, 8254 programmable Interval Timer, 8273 Programmable Direct Memory Access Controller, 8251 USART, 8279 Programmable Keyboard/Display Controller.

Text Books:
1. The 8088 and 8086 Microprocessors Programming, Interfacing, Softw, Hardware and Application; by Walter A. Triebel & Avtar Singh ; Pearson India.
2. Microprocessors and Interfacing; by Douglas V Hall ; McGraw Hill.

Reference Book:
1. Microprocessors and Micro controllers Architecture, programming and system Design 8085, 8086, 8051, 8096: by Krishna Kant; PHI.
2. The 8086 Microprocessor: Programming & Interfacing the PC- Kenneth J. Ayala, Delmar Cengage Learning, Indian Ed.
FUELS AND COMBUSTION LAB

1. ASTM distillation apparatus
2. Lubricant viscosity tests-Redwood(or)Saybolt viscometers
3. Determination of flash and fire point of fuel and lubricant (each one)
4. Aniline point tester
5. Pour point tester
6. Determination of fuel calorific value of fuel using Bomb calorimeter
7. Reid vapour pressure test.
8. Drop point of grease and mechanical penetration in grease
9. Ash, Volatile, Moisture contents of coal and oil
10. Orsat gas analysis

PRODUCTION LAB

(Minimum 06 experiments)

1. Determination of grain size, clay content, permeability and green compressive strength of molding sand. (2 to 3 experiments)
2. Foundry Practice
3. Determination of strength of brazed and soldered joints.
4. Study of non-traditional machining process (ultrasonic machining/ abrasive jet machining/ electro-discharge machining)
5. Determination of cutting forces in turning using lathe tool dynamometer
6. Determination of cutting forces in drilling using drilling tool dynamometer
7. Study on C. N.C. Machines and demonstration of making of job through CNC machine.
8. Calibration of slip gauge using sine bar
9. Measurement of roughness / straightness / flatness of surfaces
10. Study of microstructure of steel specimen
At the end of this Lab.; the students will be able to acquire basic knowledge on automobile part designing using design software apart from automobile production.

1. **INTRODUCTION:** Introduction to Automobile CAD software’s; industrial looks on CAD software’s;. Any of the Software tools like CATIA/PRO-E(Creo), the student has to practise the followings

2. **SKETCHER & AUTO CONSTRAINTS:**
   Introduction to Sketching tools like Line; Rectangular; Circle; Arc; Splines; and Fillet etc to built complex profiles; general concept and best process to constraint (Auto and Manually) a profile in Pro/E / CATIA.

3. **PART DESIGN FUNDAMENTALS:** Introduction to Design tools like Extrude; Revolve; Shell; Pad etc needed to generate solid models using various software; Material addition and subtraction about axis and plane; types of geometrical dimensional limits; numerous approaches to specify solid feature creation.

4. **ASSEMBLY DESIGN FUNDAMENTALS:** Design tools needed to create and manage assemblies and sub assemblies; analyzing and modeling an assembly; designing in context; process to insert parts from given and maintained catalogue

On the basis of above fundamentals any four of the followings
(i) Screw jack
(ii) Piston, Cylinder and connecting rod
(iii) Carburettor body
(iv) Fuel injector
(v) Gear box
(vi) Differential

Animation: Fundamentals and use of animation for drawing automobile components

**Reference:**

Manuals of Pro-E and CATIA

Shyam and Tickoo Maini., “CATIA V5 R17 Engineers Designing”.
HSSM3303 ENVIRONMENTAL ENGINEERING & SAFETY

Module – I

Module – II
(b) Air Pollution: Air pollution and pollutants, criteria pollutants, Acid deposition, Global climate change – greenhouse gases, non-criteria pollutants, air pollution meteorology, Atmospheric dispersion. Industrial Air Emission Control. Flue gas desulphurization, NOx removal, Fugitive emissions.

Module – III

Text Book :
2. Environmental Engineering by Prof B.K. Mohapatra, Seven Seas Publication, Cuttack

Reference Books
1. Environmental Engineering by Arcadio P. Sincero & Gergoria A. Sincero PHI Publication
3. Environmental Science, Curriningham & Saigo, TMH,
4. Man and Environment by Dash & Mishra
5. An Introduction to Environmental Engineering and Science by Gilbert M. Masters & Wendell P. Ela - PHI Publication.
VEHICLE BODY ENGINEERING

MODULE I

CAR BODY DETAILS 12 Hours
Types: Saloon, convertibles, Limousine, Estate Van, racing and sports car.
Visibility: regulations, driver's visibility, tests for visibility – Methods of improving visibility.
Safety: safety design, safety equipments for car.
Various body panels and Construction of Car body.

MODULE II

VEHICLE AERODYNAMICS 6 Hours
Objectives – Vehicle drag and types – various types of forces and moments – Effects of forces and moments – Side wind effects on forces and moments – Various body optimization techniques for minimum drag

BUS BODY DETAILS 6 Hours
Types: Mini bus, single decker, double decker, two level, split level and articulated bus.
Bus body lay out – Floor height – Engine location – Entrance and exit location.
Constructional details: Types of metal sections used – Regulations – Conventional and Integral type construction.

MODULE III

COMMERCIAL VEHICLE DETAILS 6 Hours
Types of body – Flat platform, drop side, fixed side, tipper body, tanker body.
Light commercial vehicle body types.
Dimensions of driver's seat in relation to controls – Drivers cab design.

BODY MATERIALS, TRIM AND MECHANISMS 6 Hours
Steel sheet, timber, plastics, GRP, properties of materials.
Corrosion – Anticorrosion methods – Selection of paint and painting process
Body trim items – Body mechanisms.

TEXT

REFERENCE:
Module I  Introduction
Pollutant formation in SI Engines, mechanism of HC and CO formation in four stroke and two stroke SI engines, NOx formation in SI engines, effects of design and operating variables on emission formation, control of evaporative emission. Two stroke engine pollution.

Pollutant formation in CI engines, smoke and particulate emissions in CI engines, effects of design and operating variables on CI engine emissions. Noise pollution from automobiles, measurement and standards.

Module II  Control of Emissions from SI and CI Engines
Design of engine, optimum selection of operating variables for control of emissions, EGR, Thermal reactors, secondary air injection, catalytic converters, catalysts, fuel modifications, fuel cells, Two stroke engine pollution control.

Module III  Measurement Techniques, Emission Standards and Test Procedure
NDIR, FID, Chemiluminescent analyzers, Gas Chromatograph, smoke meters, emission standards, chassis dynamometers, dilution tunnels.

Vehicle population assessment in metropolitan cities and contribution to pollution, effects on human health and environment, global warming.

Text books

Reference books
2 Obert.E.F.- “Internal Combustion Engines”- 1988
3 Marco Nute- " Emissions from two stroke engines, SAE Publication – 1998
Module I 12

Module II 12

Design of Clutch: Types of friction clutches, requirements of clutches, general design consideration, design the equation for power transmitted through single plate and multi plate clutch for Uniform wear and uniform pressure, design for dimensions of clutch, equation for centrifugal clutch.

Module III 12
Design of Brake: General design considerations, braking efficiency, braking torque on the shoe, effect of expanding mechanism of shoes on braking torque, braking of vehicle for two wheel drive and four wheel drive, braking of vehicle for curved path calculation of mean lining pressure and heat generation during brake operation.

Design of Suspension System: Function suspension system in automobile, design of helical coil spring, leaf spring, materials for spring, standard sizes of automobile suspension spring.

Propeller Shaft: Design of Propeller shaft, Design of universal Joint.

Books:

Reference Book:
AUTOMOTIVE ELECTRICALS & ELECTRONICS

OBJECTIVE:
To impart knowledge to the students in the principles of operation and constructional details of various Automotive Electrical and Electronic Systems like Batteries, Starting System, charging System, Ignition System, Lighting System and Dash – Board Instruments, Electronic ignition system, various sensors and the role of ECU.

Module I  BATTERIES, STARTING AND CHARGING SYSTEM  12Hr


Module II  ELECTRONIC IGNITION AND INJECTION SYSTEMS  12Hr
Spark plugs, Advance mechanisms. Different types of electronic ignition systems - variable ignition timing, distributor less ignition. Spark timing control. Cold start and warm up phases, idle speed control, acceleration and full load enrichment, deceleration fuel cutoff. Fuel control maps, integrated engine control system Electronic fuel injection systems. Engine mapping.

Module III  SENSORS AND MICROPROCESSOR IN AUTOMOBILES  12Hr
Basic sensor arrangement. Types of sensors – Oxygen sensor, fuel metering/Vehicle speed sensor, mass air flow sensor, temperature sensor, altitude sensor, pressure sensor and detonation sensor. Various actuators and its application in automobiles.

Microprocessor And Microcomputer controlled devices in automobiles such as instrument cluster, Voice warning system, Travel information system, Keyless entry system, Automatic Transmission. Environmental requirements (vibration, Temperature and EMI).

TEXTBOOK:

REFERENCES:
COMBUSTION THERMODYNAMICS AND HEAT TRANSFER

Module I  THERMODYNAMICS OF COMBUSTION  12Hr


Module II  NORMAL, ABNORMAL COMBUSTION IN SI ENGINES  12Hr
Stages of combustion – Flame propagation — Flame Limits –Flame Extinction -Rate of pressure rise – Cycle to cycle variation – Abnormal combustion – Theories of detonation – Effect of engine operating variables on combustion –Example problems.

Module III  COMBUSTION AND HEAT TRANSFER IN IC ENGINES  12Hr

Photographic studies of combustion processes – P-θ diagrams in SI and CI engines, Assembly – Temperature measurement in piston – cylinder liner – Cylinder head and engine valves.

TEXT BOOK


REFERENCES

AUTOMOTIVE AIR CONDITIONING

MODULE I
Air conditioning Fundamentals 12 Hours

MODULE II
Air Conditioning – Heating System 6 Hours

Refrigerant 6 Hours
Containers – Handling refrigerants – Tapping into the refrigerant container – Refrigeration system diagnosis – Diagnostic procedure – Ambient conditions affecting system pressures.

MODULE III
Air Routing & Temperature Control 12 Hours
Objectives – Evaporator care air flow through the dash re-circulating unit – Automatic temperature control – Duct system – Controlling flow – Vacuum reserve – Testing the air control and handling systems.

TEXT

REFERENCE:
Module-I (10 Hours)
Idea of Engineering optimization problems, Classification of optimization algorithms, Modeling of problems and principle of modeling.

Linear programming: Formulation of LPP, Graphical solution, Simplex method, Big-M method, Revised simplex method, Duality theory and its application, Dual simplex method, Sensitivity analysis in linear programming

Module -II (10 Hours)
Transportation problems: Finding an initial basic feasible solution by Northwest Corner rule, Least Cost rule, Vogel’s approximation method, Degeneracy, Optimality test, MODI method, Stepping stone method
Assignment problems: Hungarian method for solution of Assignment problems
Integer Programming: Branch and Bound algorithm for solution of integer Programming Problems
Queuing models: General characteristics, Markovian queuing model, M/M/1 model, Limited queue capacity, Multiple server, Finite sources, Queue discipline.

Module -III (10 Hours)
Non-linear programming: Introduction to non-linear programming.
Unconstraint optimization: Fibonacci and Golden Section Search method.
Constrained optimization with equality constraint: Lagrange multiplier, Projected gradient method
Constrained optimization with inequality constraint: Kuhn-Tucker condition, Quadratic programming
Introduction to Genetic Algorithm.

Recommended text books

Recommended Reference books:
Module – I (12 hours)
Review of 2-D and 3-D stress analyses, vibration, fluid flow and heat conduction problems.
FEM fundamental concepts, Variational principles, Rayleigh Ritz and Galerkin Methods.
Finite Element Modeling of one dimensional problems.
Finite Element Analysis of 2-D and 3-D framed structures.

Module – II (12 hours)
FEM formulation of 2-D and 3-D stress analysis problems.
Axisymmetric solids subjected to axisymmetric loadings.
Two-dimensional isoparametric elements and numerical integration.

Module – III (12 hours)
FE modeling of basic vibration problems
Finite element modeling of fluid flow and heat conduction problems
Computer programs: preprocessing and post processing.
Exposure to commercial FE codes such as ANSYS, NASTRAN and IDEAS etc.

Text Books
1. Finite Elements in Engineering, T.R.Chandraputla and A.D.Belegundu, PHI

Reference
1. Introduction to Finite Element Method, C.Desai and J.F.Abel, CBS publishers
3. Numerical Methods in Finite Element Analysis, K.J.Bathe and E.L.Wilson, PHI
Module I  (10 Classes)


Module II  (15 Classes)


Module III  (15 Classes)


Miscellaneous Non-conventional Technologies


Text Book:
1. Non Conventional Energy Sources: B.M Khan, TMH Publications
2. Renewable Energy Sources and Emerging Technology: D.P.Kothari and etal., PHI

Reference:
3. Non Conventional Energy Sources: H.P.Garg
5. Solar Energy Technology: Sukhatme and Nayak, TMH
AUTOMOTIVE ELECTRICAL AND ELECTRONICS LAB

0-0-3-2

Students are required to do any ten experiments.

1. Study of rectifier and filters,
2. Study on characteristics of amplifiers,
3. Study of logic gates, adder and flip-flops,
4. Study of SCR and IC timer,
5. D/A and A/D converter,
6. Assembly language programming exercise,
7. Interfacing A/D converter and simple data acquisition,
8. Interfacing Stepper motor control and CRT terminal,
9. Micro controller programming and interfacing,
10. Study of battery charging system
11. Testing of regulators and cutout.
12. Study of automotive electrical wiring
13. Diagnosis of ignition system faults

AUTOMOTIVE ENGINE & CHASSIS COMPONENTS LAB

OBJECTIVE:

• To familiarize and train the students on the constructional arrangements of different engine & Chassis system.

Study of the following engines and its components by dismantling, comparing with recent engine components and assembling various parts:

• Tata engine
• Ambassador engine
• Maruthi 800 CC engine
• Ford Car engine
• Two stroke engines (TVS Suzuki, Hero Honda, Scooters, Mopeds etc.)
• MPFI Engine

Study and measurement of the following chassis

• Tata
• Ambassador
• Maruthi car (Front engine, front wheel drive & constant velocity joint)
• Mahindra & Mahindra Jeep

Study, dismantling & assembling

• Front axle – Rzeppa joint assembly
• Rear axle
• Clutch 2 types – Coil spring& Diaphragm spring clutches
• Gear box – Sliding mesh, Constant mesh & Synchromesh Gear Box
• Transfer case
• Steering system
• Braking system
• Differential mechanism
• Power steering mechanism
COMPUTER AIDED ENGINE DESIGN LAB

OBJECTIVE:
To make the students understand the design concept and principles of various engine components, their materials and manufacturing techniques. These concepts and principles are familiarized for design of components.

- Design of piston, piston pin and piston rings and drawing of these components.
- Designing of connecting rod small end and big end, shank design, design of big and cap bolts and drawing of the connecting rod assembly.
- Design of crankshaft, balancing weight calculations, development of short long crankarms, front end and rear end details, drawing of the crankshaft assembly.
- Design and drawing of flywheel, ring gear design, drawing of the flywheel including the development of ring gear teeth.
- Design and drawing of the inlet and exhaust valves.
- Design of Cam and Camshaft, Cam profile generation. Drawing of cam and camshaft.
- Design of combustion chamber.
- Design and drawing of engine complete assembly involved with cylinder block, cylinder head, crankcase, valve ports, water jackets.
- Computer aided design of the above components.

TEXT BOOK:

REFERENCES:

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## BIJU PATNAIK UNIVERSITY OF TECHNOLOGY, ODISHA
### Automobile Engineering

#### 7th SEMESTER

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<td>Modern Vehicle Technology</td>
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**Credits (Theory)**: 18

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**Credits (Practicals/Sessionals)**: 8

**TOTAL SEMESTER CREDITS**: 26

#### 8th SEMESTER

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**Credits (Practicals/Sessionals)**: 11

**TOTAL SEMESTER CREDITS**: 20

**TOTAL CUMULATIVE CREDITS**: 204
HSSM3401 ENTREPRENEURSHIP DEVELOPMENT

Module I: Understanding Entrepreneurship 10Hrs
- Concept of Entrepreneurship, Motivation for Economic Development and Entrepreneurial Achievement, Enterprise and Society
- Why and how to start Business – Entrepreneurial traits and skills, Mind Vrs Money in Commencing New Ventures, Entrepreneurial success and failures, Environmental dynamics and change.

Entrepreneurial Process
- Step by step approach to entrepreneurial start up
- Decision for Entrepreneurial start up.

Module II: Setting up of a small Business Enterprise. 10Hrs
- Identifying the Business opportunity - Business opportunities in various sectors, formalities for setting up small enterprises in manufacturing and services, Environmental pollution and allied regulatory and non-regulatory clearances for new venture promotion in SME sector.
- Writing a Business plan, components of a B-Plan, determining Bankability of the project.

Module III: Institutional Support for SME. 10Hrs
- Central / State level Institution promoting SME.
- Financial Management in small business.
- Marketing Management, problems & strategies
- Problems of HRM – Relevant Labour – laws.

Sickness in Small Enterprises.
- Causes and symptoms of sickness – cures of sickness.
- Govt. policies on revival of sickness and remedial measures.

Reference Books:
2. Entrepreneurial Development, S.S. Khanka, S Chand
3. Entrepreneurship, Barringer BR, Ireland R.D., Pearson
4. Entrepreneurship, David H Holt, PHI
5. Entrepreneurship, Kurliko, D.F. and Attodgets RM, Cengage
6. The Dynamics of Entrepreneurial Development & Management, Vasant Desai, HPH.
7. Entrepreneurship, Roy, Oxford
8. Entrepreneurship, Hisrich, Peters, Shepherd, TMH
VEHICLE DYNAMICS

MODULE I  INTRODUCTION

MODULE II  SUSPENSION AND TYRES
Requirements, sprung mass frequency, wheel hop, wheel wobble, wheel shimmy, choice of damper characteristics and suspension spring rate, calculation of effective spring rate, vehicle suspension in fore and aft direction, roll axis and vehicle under the action of side forces. Tyre – Requirements, types, testing, dynamics, ride characteristics, power consumed by a tyre.

MODULE III  VEHICLE HANDLING AND STABILITY
Load distribution, calculation of acceleration, tractive effort and reactions for different drives, stability of a vehicle on a curved track, slope and a banked road. Oversteer under steer, steady state cornering, effect of braking, driving torques on steering, effect of camber, transient effects in cornering.

TEXT BOOKS

REFERENCES
MODERN VEHICLE TECHNOLOGY 3 0 0 3

MODULE I  ADVANCES IN ENGINES, SUSPENSION AND BRAKE SYSTEMS

Advances in Automotive Power Plants: Hybrid Vehicles – Stratified charged / lean burn engines– Hydrogen Engines–Electric vehicles– Magnetic track vehicles solar powered vehicle Combined power source vehicle. Interconnected air and liquid suspensions, Hydrolastic suspension system, Hydragas suspension, modern rear wheel brake, indirect floating calliper disc brake, self energizing disc brake, brake limiting device, anti-slide system, Closed loop suspension; Regenerative braking.

MODULE II  MODERN FUEL INJECTION AND POLLUTION CONTROL


MODULE III  AUTOMOTIVE ELECTRONICS

Types of sensors based on principle. Applications of sensors such as throttle position, mass air flow, crank shaft position, cam position, engine and wheel speed, steering position, tire pressure, brake pressure, steering torque, fuel level, crash, exhaust oxygen level (two step and linear lambda), knock, engine temperature, manifold temperature and pressure sensors. Components for electronic engine management system, open and closed loop control strategies, PID control, Look up tables.

REFERENCES
3. Crouse/Anglin “Automotive Mechanics”
TROUBLE SHOOTING, SERVICING AND MAINTENANCE OF AUTOMOBILE 3003

MODULE I RECORDS KEEPING, ENGINE MAINTENANCE AND SERVICING

Maintenance Records and Schedule: Importance of maintenance, scheduled and unscheduled maintenance, preventive maintenance details, breakdown maintenance details, vehicle log books, maintenance record forms, different service garages & its layout.

Dismantling of engine components and cleaning, cleaning methods, visual and dimensional inspections, minor and major reconditioning of various components, reconditioning methods, engine assembly, special tools used for maintenance overhauling, engine tune up.

MODULE II CHASIS MAINTENANCE AND SERVICING

Servicing, repair and maintenance of clutch, maintenance, repair and servicing of gear box, servicing of propeller shaft, servicing and maintenance aspects of differential unit, servicing of front axle and rear axle, suspension system of both rigid and independent types, servicing of brake systems, hydraulic, air systems, brake bleeding and brakes adjustments, maintenance and servicing of steering system, wheel balancing, wheel alignment.

MODULE III CIRCULATORY SYSTEMS AND VEHICLE BODY MAINTENANCE

Servicing and maintenance of fuel system of different types of vehicles, calibration and tuning of engine for optimum fuel supply. Cooling systems, water pump, radiator, thermostat, anticorrosion and antifreeze additives. Lubrication maintenance, lubricating oil changing, greasing of parts.

Maintenance and Repair of Vehicle Body: Special tools used for body repair, minor body panel beating, tinkering of body works, polishing and painting of new and old vehicle body, servicing of door locks.

TEXT BOOK
REFERENCES
5. Venk.Spicer," Automotive Maintenance and Trouble shooting ".
6. " Vehicle Service Manuals of reputed manufactures ".
Module – I (12 hrs)
**Fluid Power**
Introduction, History, Basic Law, types and Advantages of Fluid Power.
Hydraulic fluids and properties: Various types of hydraulic fluids (water, petroleum oil, Water glycols, water oil emulsion, phosphate esters and silicones), properties of Fluids and their comparison.

**Hydraulic Pumps and Actuators:**
Pumps: Basic Elements of an Oil Hydraulic System, Hydrodynamic and Hydrostatic Pumps, Classification of Positive Displacement Pumps, Gear Pumps, vane pumps and piston pumps, types, principles and application, Pump performance
Hydraulic Actuators: Hydraulic Motors; Types Hydraulic Motor Efficiencies, Semi-rotary Actuators, Vane Type Actuators, Piston Type Semi-rotary Actuator, Helical Screw Semi-rotary Actuator, different types of Hydraulic Cylinders Mounting Configurations, Methods of applying Linear Motion.

Module – II (12 hrs)
Hydraulic Valves: different types of Pressure Controls, Pressure Relief and Direction Control Valves, Flow dividers and other special purpose valves.
Selection of hydraulic components
Seals and Filters, Conditions Affecting the Selection of Sealing Devices Fluid Contamination Cleanliness Standards
Filtration of Fluids Strainers, Filter Media, Types of Filters, Filter Location Accumulators: Types and their operation, Accumulator Circuits
Servo Valves and Proportional Valves: Types, Principles and applications, comparison between servo and proportional valves.
Pneumatic valves: Types and applications, comparison of hydraulic and Pneumatic valves.
Pneumatic actuators, common pneumatic systems, Selection of pneumatic components.
Hydro – Pneumatic: Air-oil Reservoir: Air-oil Cylinder, Air-oil Intensifier, Comparison of hydro-pneumatic and Pneumatic Systems

Module III (12hrs)
Different hydraulic and pneumatic circuits, Electrical and microelectronic control of fluid power
Examples of different industrial hydraulic and pneumatic systems applications, installation, maintenance and trouble shooting, Pneumatic Logic Controls

**Text book:**
Hydraulic and Pneumatic controls by R. Srinivasan, TMH (2nd Edition)

**REFERENCE BOOK:**
OFF ROAD VEHICLES 3003

MODULE I  INTRODUCTION TO OFF-ROAD VEHICLES
Multiaxle vehicles. Heavy duty petrol engines and high speed diesel engines, air cooled and water cooled engines and air filters as in off highway vehicles. Performance characteristics of vehicles, resistance to digging and motion, tractive effort, power required, number of speeds and gear ratios desirable, double reduction arrangements. Bush cutter, stampers, Tree dozer, Rippers.

MODULE II  EARTH MOVING EQUIPMENTS
Earth Moving Machines: Bulldozers, cable and hydraulic dozers. Crawler track, running and steering gears, scrapers, drag and self powered types - Dump trucks and dumpers - Loaders, single bucket, multi bucket and rotary types. Scrapers, elevating graders, self powered scrapers and graders. Land Clearing Machines:

MODULE III SPECIAL PURPOSE VEHICLES

TEXTBOOK
2. SAE Handbook Volume III

REFERENCES
1. B. Geleman and M. Moskovin, Farm tractors, MIR publishers, Moscow.
AUTOMOTIVE SAFETY 3 0 0 3

MODULE I  INTRODUCTION TO SAFETY
Vehicle structural crashworthiness and Crash testing. Design of crash crumple zones, modeling and simulation studies, Optimization of vehicle structures for crashworthiness, Types of impacts, and Impact with rebound, movable barrier tests, Analysis and simulation of vehicle in barrier impacts, Roll over crash tests, Behavior of specific body structures in crash testing, Photographic analysis of impact tests, regulatory requirements for crash testing.

MODULE II  SAFETY CONCEPTS AND EQUIPMENTS 9
Active safety: driving safety, conditional safety, perceptibility safety, operating safety, passive safety: exterior safety, interior safety, deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact. Seat belt, regulations, automatic seat belt tightener system, collapsible steering column, tiltable steering wheel, air bags, electronic system for activating air bags, bumper design for safety.

MODULE III  COLLISION WARNING, COMFORT AND CONVENIENCE SYSTEM
Collision warning system, causes of rear end collision, frontal object detection, rear vehicle object detection system, object detection system with braking system interactions. Steering and mirror adjustment, central locking system, Garage door opening system, tyre pressure control system, rain sensor system, environment information system

TEXT BOOK

REFERENCES
Module I (8 hours)
Product design considerations, product planning, product development, value analysis, product specification. Role of computer in product design.
Product design for sand casting: design of gating system and risering.

Module II (12 hours)
Forging design: allowances, die design for drop forging, design of flash and gutter, upset forging die design.
Sheet metal working: Design consideration for shearing, blanking piercing, deep drawing operation, Die design for sheet metal operations, progressive and compound die, strippers , stops, strip layout.

Module III (16 hours)
Design of jigs and fixtures, principle of location and clamping, clamping methods, locating methods, Drill Jig bushing, Indexing type drilling Jig. Design of single point cutting tool, broach and form tool. Design of limit gauges.

Text Books:
3. A Textbook of Production Engineering, P.C. Sharma, S. Chand & Co

Reference Books:
Module I:
Concept scope and objectives of HRM. Relationship between HRM and HRD. The challenges for HRM – Environmental, organizational and Individual. Role and functions of HR managers in the changing business scenario.
Human Resources Planning – overview, Recruitment – concept, objectives, legal framework regulating recruitment in India, Selection – Objectives and methods, Test and interviews, Induction and orientation, validity and reliability of Tests and interviews.

Module II:

Module III:
Training and Development – Training need Assessment, Types of Training Programs – on the job and off the job training programs, Evaluation of effectiveness of training programs.

Books Recommended
2. HRM - Text and cases – Aswathappa, THM
3. Managing Human Resources – Gomez, Belkin & Cardy, PHI.
4. HRM – Snell, Bohlander, Vohra – Cengage Publication
Module – I (14 hours)
1. Introduction:
Classification and characteristics of composite materials, mechanical behaviour of composites, constituents, Reinforcements, Matrices, Fillers, Additives, Applications and advantages of composites.
2. Processing:
Initial form of constituent materials, Manufacturing procedures for fibre-reinforced plastics, quality control.
3. Macromechanical Behaviour:
Stress strain relations of anisotropic materials - Engineering constants for orthotropic materials, Stress strain relations for specially orthotropic lamina. Transformation relationships for a lamina of arbitrary fibre orientation.

Module – II (12 hours)

Module – III (10 hours)
FRP Composite Laminate designation and codes, Macromechanical Behaviour of FRP Composite Laminates, Classical Lamination Theory.
General Design Consideration and Suitable laminating Scheme.

Text Book

Reference Book:
3. Composite materials, Broutman & Crock,
ENGINE TESTING AND EMISSION MEASUREMENT LAB

1. Study and use of IC engine testing Dynamometers.
2. Study of 2 and 4 wheeler chassis Dynamometers.
3. Study and use of Pressure pickups, charge amplifier, storage oscilloscope and signal analysers used for IC engine testing.
4. Performance study of petrol engine at full throttle and part throttle conditions.
5. Performance study of diesel engine both at full load and part load conditions.
6. Morse test on petrol and diesel engines.
7. Determination of compression ratio, volumetric efficiency and optimum cooling water flow rate in IC engines.
8. Head balance test on a Automotive diesel engine.
10. Testing of 2 and 4 wheelers using chassis dynamometers.
11. Study of NDIR Gas Analyser and FID.
12. Study of Chemiluminescent NOx analyzer.
14. Diesel smoke measurement.

VEHICLE MAINTENANCE AND RECONDITIONING LAB

1. Study and layout of an automobile repair, service and maintenance shop.
2. Study and preparation of different statements/records required for the repair and maintenance works.
3. Cylinder reboring - checking the cylinder bore, Setting the tool and reboring.
4. Valve grinding, valve lapping - Setting the valve angle, grinding and lapping and checking for valve leakage.
5. Calibration of fuel injection pump
6. Minor and major tune up of gasoline and diesel engines
7. Study and checking of wheel alignment - testing of camber, caster.
8. Testing kingpin inclination, toe-in and toe-out.
9. Brake adjustment and Brake bleeding.
10. Simple tinkering, soldeting works of body panels, study of door lock and window glass rising mechanisms.
11. Battery testing and maintenance.
12. Practice the following:
   i) Adjustment of pedal play in clutch, brake, hand brake lever and steering wheel play
   ii) Air bleeding from hydraulic brakes, air bleeding of diesel fuel system
   iii) Wheel bearings tightening and adjustment
   iv) Adjustment of head lights beam
   v) Removal and fitting of tyre and tube
FEMT6401 TOTAL QUALITY MANAGEMENT

Module – I (12 hours)
Thoughts/ Contribution of Quality Gurus: Deming’s 14 Points, Deming PDCA Cycle, Juran’s Trilogy, and Crosby’s Zero Defect.
Core Concepts of TQM: Top Management Leadership, Customer Orientation, Total Employee Involvement, Continuous Process Improvement
Supplier Partnership: Partnering, Sourcing, Selection, Certification, Relation development

Module – II (12 hours)
Concept of Quality Control and Quality Improvement: Costs of Quality - Prevention, Appraisal, Internal Failure, External Failure.
Failure: Random andAssignable causes; Statistical Process Control Charts – X & R chart, p-chart, c-chart, Concept of process capability
Acceptance Sampling and OC curve, Buyer risk and Supplier risk, Average Outgoing Quality
Emphasis on small improvements – Kaizen, People participation Quality Circle, QC Tools (old) & 7 Tools (new), Conditions for Success of TQM

Module – III (11 hours)
Overview of some other initiatives of process improvement: Six Sigma, TPM, Lean Manufacturing
Some tools for analysis: Quality Benchmarking, Quality Function Deployment (QFD), Failure Mode and Effect Analysis (FMEA)

Books:
1. Mukherjee - “Total Quality Management”, PHI
4. Gryna, Chua,& Defeo-“Quality Planning & Analysis for Enterprise Quality”, TMH
5. Montogomery, -“Introduction to Statistical Quality Control”, John Wiley & Sons
FUELS AND LUBRICANTS

MODULE I PRODUCTION OF FUELS AND LUBRICANTS
Structure of petroleum, refining process, fuels, thermal cracking, catalytic cracking, polymerization, alkylation, isomerisation, blending, products of refining process. Introduction to production of alternative fuels such as liquid fuels such as alcohols, biodiesel and gaseous fuels such as LPG, CNG.

Production of lubricating oil base stocks, manufacture of finished automotive lubricants.

MODULE II FUEL PROPERTIES, TESTING AND RATING OF FUELS
Thermo-chemistry of fuels, properties and testing of fuels, relative density, calorific value, distillation, vapour pressure, flash point, spontaneous ignition temperature, viscosity, pour point, flammability, ignitability, diesel index, API gravity, aniline point etc.

SI Engine combustion-normal combustion, knocking, octane rating, fuel requirements. CI Engine-combustion, diesel knock, cetane rating, fuel requirements. Additive - mechanism, requirements of an additive, petrol fuel additives and diesel fuel additives – specifications of fuels.

MODULE III THEORY OF LUBRICATION AND LUBRICANTS
Engine friction: introduction, total engine friction, effect of engine variables on friction, hydrodynamic lubrication, elasto hydrodynamic lubrication, boundary lubrication, bearing lubrication, functions of the lubrication system, introduction to design of a lubricating system.

Specific requirements for automotive lubricants, oxidation deterioration and degradation of lubricants, additives and additive mechanism, synthetic lubricants, classification of lubricating oils, properties of lubricating oils, tests on lubricants. Grease, classification, properties, test used in grease.

TEXT BOOKS

REFERENCES
FLEET MANAGEMENT 3003

MODULE I VEHICLE MANAGEMENT AND OPERATION


MODULE II VEHICLE PARTS, SUPPLY MANAGEMENT AND BUDGET

MODULE III SCHEDULING, FARE STRUCTURE AND VEHICLE ACT

Schedules and sections – Registration of motor vehicles – Licensing of drivers – Control of permits – Limits of speed – traffic signs – Constructional regulations – Description of goods carrier, delivery man, tanker, tipper, Municipal, fire fighting and break down service vehicle.

TEXT BOOK

REFERENCES
AUTOMOTIVE AERODYNAMICS 3003

MODULE I AERODYNAMIC DRAG OF CARS
Resistance to vehicle motion, performance, fuel consumption and performance potential of vehicle aerodynamics, 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.

MODULE II 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. The origin of forces and moments on a vehicle, the effects of forces and moments, characteristics of forces and moments, dirt accumulation on the vehicle, wind noise, drag reduction in commercial vehicles.

MODULE III WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS
Introduction, types and principle of wind tunnel technology, limitation of simulation, stress with scale models, full scale wind tunnels, measurement techniques, wind tunnel testing: flow visualization techniques, scale model testing, component balance to measure forces and moments. road testing methods, numerical methods.

TEXT BOOK

REFERENCES
MODULE I INTRODUCTION AND SINGLE DEGREE OF FREEDOM SYSTEM
(a) Damped free vibrations, Types of damping, Logarithmic decrement, Coulomb damping, and damping materials.
(b) Forced Vibrations: Types of excitation, Forced excitation, Support excitation, Excitation due to unbalance in machines, Response due to above types of excitations, transmissibility, Force transmissibility & motion transmissibility, Vibration isolators, commercial isolation materials & shock mounts.
(c) Forced vibrations of un-damped systems due to non-harmonic excitations

MODULE II TWO DEGREE OF FREEDOM SYSTEM AND VIBRATION MEASURING INSTRUMENTS
(a) Free un-damped vibrations – Principal modes and natural frequencies, Co-ordinate coupling and principal co-ordinates.

MODULE III RATING AND REGULATION OF SOUND AND NOISE
Sound level & subjective response to sound Frequency dependent human response to sound, Sound pressure dependent human response, Decibel scale, Relation among sound power, Sound intensity & sound pressure level, Octave band analysis.

TEXT BOOK
1 Mechanical Vibration by G. K. Grover, Published by Nemchand & Brothers, Roorkee

REFERENCE BOOKS
1. Mechanical Vibration – Austin Church, Wiely Eastern.
2. Schaumm’s Outline series in Mechanical Vibration by S. Graham Kelly
3. Mechanical Vibration by Dr. V. P. Singh, Published by S. Chand & Sons New Delhi.
5. Mechanical vibration & noise engineering by A.G.Ambekar prentice hall of INDIA
6. Kinematics, Dynamics and Design of Machinery by Waldron Willey India
7. Fundamentals of Vibrations By Balchandran Magrab CENGAGE LEARNING