STATE COUNCIL OF TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA
TEACHING AND EVALUATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES

DISCIPLINE: AUTOMOBILE ENGINEERING									**SEMESTER: 3RD**			
SL NO	**SUBJECT CODE**	**SUBJECT**	**PERIODS**			**EVALUATION SCHEME**						
			L	**T**	**P**	**INTERNAL EXAM**			**END SEM EXAM**	**TERM WORK**	**PRACTICAL EXAM**	**TOTAL MARKS**
						TA	**CT**	**Total**				
THEORY												
1.	BST 301	ENGINEERING MATHEMATICS-III	4	1	-	10	20	30	70			100
2.	MET 321	STRENGTH OF MATERIAL	4	1	-	10	20	30	70			100
3.	MET 322	ENGINEERING MATERIAL	4	-	-	10	20	30	70			100
4.	AET 301	MANUFACTURING TECHNOLOGY-I	4	1	-	10	20	30	70			100
PRACTICAL/TERM WORK												
5.	MEP 321	MECHANICAL ENGG. DRAWING*	-	-	6				100	50		150
6	MEP 322	MECHANICAL ENGINEERING LAB	-	-	6					50	25	75
7.	MEP 323	WORKSHOP PRACTICE-II	-	-	7					50	25	75
8.	AEP 301	TECHNICAL SEMINAR	-	-	1					25	25	50
GRAND TOTAL			**16**	**03**	**20**	**40**	**80**	**120**	**380**	**175**	**75**	**750**

Total Contact hours per week: 39
Abbreviations: L-Lecture, T-Tutorial, P-Practical, TA- Teacher's Assessment, CT- Class test
Minimum Pass Mark in each Theory Subject is 35% and in Practical subject is 50% * Minimum pass mark in End Sem Exam is 35% & that in term work is 50%

ENGINEERING MATHEMATICS – III
(COMMON TO ELECT/CSE/ETC, AE & I/CP/IT/MECH/AUTO)

Name of the Course: Diploma in **AUTOMOBILE ENGINEERING**			
Course code:	BST 301	Semester	3rd
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Class Test:	20
Tutorial:	1 P/ week	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

A. RATIONALE:

The subject Engineering Mathematics-III, is a common paper for Engineering branches. This subject includes Matrices, Laplace Transforms, Fourier Series, Differential Equations and Numerical Methods etc. for solution of Engineering problems.

B. OBJECTIVE:

On completion of study of Engineering Mathematics-III, the students will be able to:

1. Apply matrices in Engineering mechanics, electrical circuits and linear programming.
2. Transform Engineering problems to mathematical models with the help of differential equations and familiarize with the methods of solving by analytical methods, transform method, operator method and numerical methods.
3. Solve algebraic and transcendental equations by Iterative methods easily programmable in computers.
4. Analysis data and develop interpolating polynomials through method of differences.

Topic wise distribution of periods

Sl. No.	Topics	Period
1	Matrices	04
2	Differential equation	12
3	Laplace transform	14
4	Fourier series	14
5	Numerical methods	04
6	Finite difference & Interpolation	12
	Total:	**60**

COURSE CONTENTS

1. MATRICES **04**

1.1 Define rank of a matrix.
1.2 Perform elementary row transformation to determine the rank of a matrix.
1.3 State Rouche's Theorem for consistency of a system of linear equations in 'n' unknowns.
1.4 Solve equations in three unknowns testing consistency.

2. Linear Differential Equations **12**

2.1 Define Homogeneous and non-homogeneous differential equations with constant coefficients with examples.
2.2 Find general solution of linear equations in terms of C.F. and P.I.
2.3 Derive rules of finding C.F. and P.I. in terms of operator D.
2.4 Define Partial Differential equations(P.D.E.)
2.5 Form partial differential equations by eliminating arbitrary constants and arbitrary functions.
2.6 Solve partial differential equations of the form P.p+Q.q=R
2.7 Solve Engineering problems on 2.1-2.6.

3. LAPLACE TRANSFORMS **14**

3.1 Define Gamma function and $\Gamma(n+1) = n!$ and find $\Gamma(1/2) = \sqrt{\pi}$ (No problem)

3.2 Define Laplace transform of a function f(t) and inverse laplace transform.
3.3 Derive L.T. of standard functions and explain existence conditions of L.T.
3.4 Explain linear, shifting and Change of scale property of L.T.
3.5 Formulate L.T. of derivatives, integrals, multiplication by t^n and division by t.
3.6 Derive formula of inverse L.T.
3.7 Solve Linear Differential Equations with constant coefficients associated with initial conditions using Transform Method(upto 2nd order only).
3.8 Solve problems on 3.2- 3.7

4 FOURIER SERIES **14**

4.1 Define periodic functions
4.2 State Dirichlet's conditions for the Fourier expansion of a function and its convergence.
4.3 Express periodic function $f(x)$ satisfying Dirichlet's conditions as a Fourier series.
4.4 State Euler's formulae.
4.5 Define Even and Odd functions and Obtain F.S. in $(0 \le x \le 2\pi$ and $-\pi \le x \le \pi)$
4.6 Obtain F.S. of continuous functions and functions having points of discontinuity in $(0 \le x \le 2\pi$ and $-\pi \le x \le \pi)$.
4.7 Solve problems on 4.1-4.6

5 NUMERICAL METHODS **04**

5.1 Appraise limitations of analytic method of solution of algebraic and transcendental equations.
5.2 Derive Iterative formula for finding the solutions of algebraic and transcendental equations by:
a) Bisection method
b) Newton Raphson method
5.3 Solve problems on 5.2

6 FINITE DIFFERENCE and INTERPOLATION **12**

6.1 Explain finite difference and form table of forward and backward difference.
6.2 Define shift operator(E) and establish relation between E and difference operator(Δ).
6.3 Derive Newton's forward and backward interpolation formula for equal interval.
6.4 State Lagrange's Interpolation formula for unequal intervals.
6.5 Explain numerical integration and state
6.5.1 Newton-Cote's formula(No derivation)
6.5.2 Trapezoidal Rule
6.5.3 Simpson's 1/3rd rule
6.6 Solve Problems on 6.1-6.5

Learning Resources:

Text Books

Sl.No	Name of Authors	Title of the Book	Name of the publisher
1	Dr.B.S. Grewal	Higher Engineering Mathematics	Khanna Publishers

Reference Book

1	Text book of Engineering Mathematics-III	By C.R.Mallick	Kalyani Publication

STRENGTH OF MATERIAL

Name of the Course: Diploma in **AUTOMOBILE ENGINEERING**			
Course code:	MET 321	Semester	3RD
Total Period:	75	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Tutorial:	1 P/W	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

RATIONALE:
Strength of Materials deals with the internal behavior of solid bodies under the action of external forces. The subject focuses on mechanical properties of materials, analysis of stress, strain and deformations. Therefore, it is an important basic subject for students for mechanical and automobile engineering.

Course objectives
Students will develop ability towards

- Determination of stress, strain under uniaxial loading (due to static or impact load and temperature) in simple and single core composite bars.
- Determination of stress, strain and change in geometrical parameters of cylindrical and spherical shells due to pressure
- Realization of shear stress besides normal stress and computation of resultant stress in two dimensional objects.
- Drawing bending moment and shear force diagram and locating points in a beam where the effect is maximum or minimum.
- Determination of bending stress and torsion stress in simple cases

Determination of critical load in slender columns thus realizing combined effect of axial and bending load.

Topic wise distribution of periods

Sl. No.	Topic	Periods
1	Simple stress and strain	06
2	Two dimensional Stress system	06
3	Stress in composite section	06
4	Thin cylindrical and spherical shells	06
5	Bending moments and shear force	08
6	Theory of simple bending	08
7	Combined axial and bending stress	08
8	Torsion	07
9	Testing of materials	05
	Total	**60**

COURSE CONTENTS (in terms of specific objectives):

1.0 Simple stress and strain
- 1.1 Explain types of loads, stresses, strain, elastic constants, Poisson's ratio
- 1.2 Establish the relation between three elastic constants (E, G, K)

2.0 Two dimensional stress systems
- 2.1 Determine normal stress, shear stress and resultant stress on oblique plane

2.2 Define principle plane
2.3 Define principle stress
2.4 Determine principle plane, principle stress analytically
2.5 Determine principle stress from Mohr's circle.

3.0 Axially loaded members (Stress in composite section)
3.1 Determine stresses in composite bar
3.2 Define temperature stress
3.3 Determine temperature stress in composite bar (single core only)
3.4 Define strain energy and resilience
3.5 Determine stresses due to gradually applied, suddenly applied and impact load

4.0 Thin cylinder and spherical shells under internal pressure
4.1 State assumptions for thin shells
4.2 Define hoop stress and longitudinal stress
4.3 Define hoop strain and longitudinal strain
4.4 Compute hoop stress, longitudinal stress, hoop strain, longitudinal strain and volumetric strain
4.5 Compute the change in length, diameter and volume

5.0 Bending movement and shear force
5.1 State types of beam and loading
5.2 Define and explain shear force and bending moment, shear force diagram and bending moment diagram
5.3 Determine the B.M and S.F. by analytical method subjected to concentrated load, uniformly distributed load for:
5.3.1 Cantilever beam
5.3.2 Simply supported beam
5.3.3 Over hanging beam
5.3.4 Draw the S.F and B.M diagram for clauses in 5.3.1, 5.3.2 & 5.3.3
5.4 Define point of contraflexure
5.4.1 Determine the point of contraflexure

6.0 Theory of simple bending.
6.1 State various types of sections (symmetrical, unsymmetrical and built up sections)
6.2 State the assumption for simple bending
6.3 Derive the relation M/I=fb/y=E/R
6.4 Define the section modulus, flexural rigidity and moment of resistance
6.5 Explain the distribution of bending stress across T, & I sections.
6.6 Solve simple problems on above

7.0 Combined axial and bending stress
7.1 Define columns (long and short)
7.2 Derive the maximum stress developed in short column under eccentric loading
7.3 Define buckling load
7.4 State the formula (no derivation) for buckling load under various end conditions

8.0 Torsion
8.1 Define torsion
8.2 State the assumption of pure torsion
8.3 Derive the relation T/1p=fs/r=CΘ/L
8.4 Differentiate between the strength of hollow and solid shaft
8.5 Solve simple problem on above

9.0 Testing of material

9.1 Destructive Testing

9.1.1 Tensile testing

9.1.2 Hardness testing

9.1.3 Torsion testing

9.1.4 Creep and fatigue testing

9.1.5 Impact testing

Learning resources:

Text Books:

Sl.No.	Author	Title	Publisher
1.	S. Ramamrutham	Strength of material	Dhanpat Rai Pub. Co
2.	R. S. Khurmi	Strength of material	

Reference Books.

1.	I. B. Prasad	Strength of material	
2.	S. P. Timoshenko and D. H. Young	Element of strength of materials	East West Press
3.	W. A. Nash	Theory and problems of Strength of materials	Mc. Graw Hill Inc
4.	C. Mohapatra	Mechanical testing of materials (Theory and Practice)	
5.	Sadhu Singh	Strength of Materials	Khanna Publishers
6.	Egor P. Popor	Engineering Mechanics of Solids	Prentice Hall Private Ltd
7.	Dongre	Strength of Materials	SCITECH

ENGINEERING MATERIALS

Name of the Course: Diploma in **AUTOMOBILE ENGINEERING**			
Course code:	MET 322	Semester	3rd
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/week	Class Test:	20
Tutorial:		Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

RATIONALE:

Entire field of engineering deals with use of host of materials for making products for human consumption. These materials include wide spectrum of element, metals, alloys, Polymers, Ceramics and composites with diverse properties, It is imperative that an engineer from any field should have a good knowledge of such materials and their properties.

Course Objectives

Students will develop ability towards

- Realizing material requirements
- Realizing application area of ferrous, non ferrous and alloys
- Comprehending micro-structural changes during iron-carbon phase transformation process
- Comprehending effect of heat treatment and its effect towards change in material properties

Comprehending continuity during evolution in engineering materials and development of modern engineering materials

Topic wise distribution of periods

Sl. No.	Topic	Periods
1	Material classification	03
2	Imperfection in crystal	10
3	Iron carbon system	10
4	Heat treatment	10
5	Nonferrous metals & alloys	10
6	Bearing material	04
7	Spring material	03
8	Polymers	05
9	Composites & Ceramic	05
	TOTAL	60

COURSE CONTENTS (in terms of specific objectives):

1.0 Material classification

1.1 Classify material into ferrous and non-ferrous metals and alloys.

1.2 Understand factors affecting the selection of materials for engineering Purposes such as

a) Properties of materials
b) Performance requirements
c) Materials reliability
d) Safety
e) Physical attributes

f) Environmental conditions
g) Availability
h) Disposability
i) Economic factors

2.0 Imperfection in crystals
- 2.1 Explain crystal, ideal crystal and crystal imperfection
- 2.2 Classify crystal imperfections or defects such as point defects, line defects, surface or gain boundary defects and volume defects
- 2.3 Explain types of point defects such as vacancies, interstitialies and impurities.
- 2.4 Explain types of line defects such as dislocation and screw dislocation
- 2.5 State various causes of dislocation
- 2.6 Explain effect of imperfection on metal properties
- 2.7 Explain deformation by slip
- 2.8 Explain deformation by twinning
- 2.9 Explain properties changes by deformation.

3.0 Iron carbon system
- 3.1 Understand basic concept of phase diagram cooling curves.
- 3.2 Explain the iron-carbon equilibrium diagram with salient micro constituents of iron and steel.

4.0 Heat Treatment
- 4.1 Explain purpose of heat treatment
- 4.2 Describe processes of heat treatment and elaborate the methods of Annealing, normalizing, hardening, tempering, mar tempering, age hardening and surface hardening methods.
- 4.3 List effects of heat treatment on the properties of steel
- 4.4 Explain hardenability of steel

5.0 Non ferrous alloys
- 5.1 Describe composition, properties and the use of
  - 5.1.1 Aluminum alloys such as duralumin, y-alloy
  - 5.1.2 Copper alloys such as
    - 5.1.2.1 Copper-aluminum (the aluminum bronzes)
    - 5.1.2.2 Copper-tin-antimony (Babbit metal)
    - 5.1.2.3 Copper-tin (tin bronzes)
    - 5.1.2.4 Copper-tin-phosphorous (phosphor bronzes)
    - 5.1.2.5 Copper-zinc (brass)
    - 5.1.2.6 Copper-nickel (the cupro-nickels)
  - 5.1.3 Predominating elements of lead alloys
  - 5.1.4 Predominating elements of zinc alloys
  - 5.1.5 Predominating elements of nickel alloys
- 5.2 Name the alloys for high temperature services & metals for nuclear Power Plants.

6.0 Bearing Material
- 6.1 Classify bearing metals
- 6.2 Describe composition, properties and use of copper-base bearing metal, tin-base bearing metal, lead base bearing metal and cadmium-base bearing metal

7.0 Spring Material
- 7.1 List types and properties of iron-base spring material
- 7.2 List types and properties of copper-base spring material

8.0 Polymers
- 8.1 List properties and application of thermo-plastic and Thermo setting plastics
- 8.2 List properties of elastomers

9.0 Composites and Ceramics

9.1 Classify composite materials
9.2 Explain particle-reinforced & fiber reinforced composites and their properties
9.3 Classify and state application of ceramics

Learning Resources:

Text Books:

Sl.No	Author	Title	Publisher
1.	S. K. Hazra Choudhury	Material Science & Processes	
2.	Chinmaya Mohapatra	Introduction to Engineering Materials	JJPP

Reference Books

1.	O. P. Khanna	A textbook of material science and metallurgy	
2.	G. B.S. Narang	A text book of material science	
3.	R. K. Rajput	Engineering materials and metallurgy	
4.	Srivastav and Srinivasan	Science of Engineering Materials	
5.	P. K. Palanisamy	Materials Science	

MANUFACTURING TECHNOLOGY-I

Name of the Course: Diploma in **AUTOMOBILE ENGINEERING**			
Course code:	AET 301	Semester	3rd
Total Period:	75	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Tutorial:	1 P/W	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

RATIONALE:

Engineering basically means productions of goods and services for human consumption. The major function of mechanical engineering is to manufacture various products using machineries, production processes and production management techniques. Therefore, this is one of the important subjects to be learned by a mechanical and automobile engineer.

Topic wise distribution of periods

Sl. No.	Topic	Periods
1	Forging	08
2	Metal forming	10
3	Foundry	16
4	Welding	15
5	Soldering & brazing	05
6	Sheet metal works	06
	Total	60

COURSE CONTENTS (in terms of specific objectives):

1.0 Forging

1.1 Describe open and closed hearth heating furnaces.

1.2 Explain different forging hand tools with size, specification and uses

1.3 Describe various forging process such as hand forging, machine forging, drop forging, stamping, bending

2.0 Metal Forming

2.1 Explain fundamentals of rolling & extrusion

2.2 Describe various rolling process and specify the field application with limitation.

2.3 Describe different types of extrusion process such as direct, indirect and impact extrusions with field of application

3.0 Foundry

3.1 Describe various foundry tools and their uses.

3.2 Describe construction of core and core boxes.

3.3 Classify different types of pattern and state various pattern allowances.
3.4 Describe different methods of moulding and core making
3.5 Explain different types of moulding sands with their consumption and properties and specify different binding material.
3.6 Describe construction and working of cupola furnace and induction furnace.
3.7 Describe construction and working of furnaces such as crucible and pit furnace.
3.8 Explain different methods of pouring with pouring equipment such as ladle and lifting tackles.
3.9 List various casting defects with their causes and remedies.

4.0 Welding
4.1 Define welding, classify various welding processes and explain fluxes in welding
4.2 Describe oxy acetylene welding process with equipments required
4.3 Explain various types of flames, their adjustments and precautions in flame cutting
4.4 Specify arc welding electrodes
4.5 Explain welding current and voltage rating
4.6 Describe arc welding equipments such as welding transformer and welding generator set.
4.7 Classify resistance welding process
4.8 Describe various resistance welding process such as butt welding, spot welding, flash welding projection welding and seam welding
4.9 List various safety measures to be taken in welding
4.10 State different welding defects with causes and remedies
4.11 Explain TIG and MIG welding process and elaborate their specific field of application

5.0 Soldering and Brazing:
5.1 Define soldering
5.2 Classify solders
5.3 Explain different procedure of soldering
5.4 Define brazing
5.5 State different filler materials
5.6 Explain different procedure of brazing

6.0 Sheet Metal Works
6.1 Describe different metals used in a sheet metal works with their engineering application.
6.2 Describe various sheet operations in sheet metal working like Bending, Drawing, and Spinning.
6.3 State different types of joints and allowances.
6.4 Describe press works like Blanking, Piercing, Trimming

Learning Resources:

Text Books:

Sl.No	Author	Title	Publisher
	Hazra Choudhury	Workshop Technology (Part-I)	Media Promoters and Publications Pvt. Ltd.
1.	P. N. Rao	Manufacturing Process	
2.	Ghosh, Mallick	Manufacturing Process	

MECHANICAL ENGG. DRAWING

Name of the Course: Diploma in AUTOMOBILE ENGINEERING			
Course code:	MEP 321	Semester	3rd
Total Period:	90	Examination	4 hrs
Theory periods:	6 P/W	Term work :	50
Maximum marks:	150	End Semester Examination:	100

Rationale:
Drawing is the language of engineer for learning and practicing mechanical and automobile engineering, mechanical engineering is most important.

Objectives:
After completing the course students will able to read and prepare the drawing of various mechanical components and devices.

COURSE CONTENTS:

1. Orthographic views
   - 1.1 Draw three orthographic views from the isometric drawing
   - 1.2 Complete third view from given two views
   - 1.3 Draw missing lines from the given views
   - 1.4 Give dimensions of views
2. Draw different types of
   - 2.1 Bolts, Nuts, Threads
   - 2.2 Screw, Rivets
   - 2.3 Joints
     - 2.3.1 Cotter joints
     - 2.3.2 Knuckle joints
     - 2.3.3 Pipe joints
3. Draw Coupling
   - 3.1 Box coupling
   - 3.2 Flange coupling
   - 3.3 Draw Bearings
4. Draw Bearing
   - 4.1 Rigid pedestal foot step bearing
   - 4.2 Ball bearing mounted on shaft journal
5. Draw machine parts
   - 5.1 Stuffing box

5.2 Crank

5.3 Piston

6. Draw flat belt pulley.

Learning Resources:

Sl no	Author	Title	Publisher
1.	R. K. Dhawan	A text book of machine drawing	S. Chand & Co
2.	T. Jones and J. Jones	Machine Drawing	
3.	N. D. Bhatt	Engineering and machine drawing	Charotar Book Stall
4.	Basudev Bhatacharya	Machine drawing	Oxford university press.

MECHANICAL ENGINEERING LAB

Name of the Course: Diploma in AUTOMOBILE ENGINEERING			
Course code:	MEP 322	Semester	3RD
Total Period:	90	Examination	4 hrs
Lab. periods:	6 P/W	Term Work	50
Maximum marks:	75	End Semester Examination:	25

Rationale:
Engineering is a practical, field oriented professional. It is essential that the mechanical and automobile engineering students should realize their knowledge and understanding of various subjects through practical experiments in the laboratories.

Objectives:
To identify, specify, handle start (where applicable) different equipment and laboratory set up and perform respective experiments in the laboratories pertaining to engineering mechanics, strength of materials and thermal engineering.

1. Engg. Mechanics lab.

1.1 Determination of reactions at support of loaded beam.

2. Strength of material lab.

2.1 Determine young's modulus by searl's apparatus.
2.2 Perform tensile test of given specimen using in universal testing machine
2.3 Perform compression test of given specimen by compression of testing machine
2.4 Determine hardness of different metals by rockwell/brinell hardness testing m/c
2.5 Determine impact strength of ductile materials by izod/charpy's method test.
2.6 Determine rigidity modulus by torsion testing machine

3. Thermal engineering lab.

3.1 Study and demonstration of two stroke & four stroke engine.
3.2 Study of air compressor: valve application & h.p mgt.
3.3 Study of ice plant
3.4 Study of domestic refrigerator
3.5 Study of boiler
3.6 Study of steam engine

N.b.: minimum 10 experiment to be performed .

WORKSHOP PRACTICE-II

Name of the Course: Diploma in AUTOMOBILE ENGINEERING			
Course code:	MEP 323	Semester	3RD
Total Period:	105	Examination	4 hrs
Lab. periods:	7 P/W	Term Work	50
Maximum marks:	75	End Semester Examination:	25

Rationale:
Manufacturing of products is done through use various machineries and process in industry. It is therefore, essential for Mechanical students. To have practical training in these manufacturing processes and operation of the machineries.

1. **Fitting**
   - 1.1 Study and use common precision measuring tools.
     - 1.1.1 Sine bar
     - 1.1.2 Combination square slip gauge
     - 1.1.3 Dial test indicator
     - 1.1.4 Height gauge
     - 1.1.5 Go and no go gauge
   - **1.2 Do jobs**
     - 1.2.1 Preparation of caliper
     - 1.2.2 Preparation of try square
     - 1.2.3 Preparation of hammer

2. **Smithy:**
   - 2.1 Study of smithy hand tools, machines and their uses.
   - 2.2 Observe Demonstration types of job
   - 2.3 Perform jobs
     - 2.3.1 Door ring with ook
     - 2.3.2 Octagonal flat chisel

3. **Carpentry and pattern making:**
   - 3.1 Carpentry
     - 3.1.1 Study carpentry hand tools, machine tools & their use.
     - 3.1.2 Study Timber and their uses.
     - 3.1.3 Perform different carpentry operations such as planning, sawing & chiseling.
     - 3.1.4 Do jobs
       - 3.1.4.1 Cutting of slot. Botch. Mortise & Tenon
       - 3.1.4.2 Single Dovetail joints
   - 3.2 Comply with safety norms.

4. **Turning**
   - 4.1 Study of a lathe machine & its accessories

4.2 Perform jobs involving the various operations

- 4.2.1 Plain turning
- 4.2.2 Step turning
- 4.2.3 Taper turning
- 4.2.4 Grooving
- 4.2.5 Chamfering
- 4.2.6 External threading