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

DISCIPLINE: MECHANICAL ENGINEERING						**SEMESTER: 4TH**						
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.	MET 401	THEORY OF MACHINES	4			10	20	30	70			100
2.	MET 402	MANUFACTURING TECHNOLOGY	4			10	20	30	70			100
3.	MET 403	THERMAL ENGINEERING-II	4			10	20	30	70			100
4.	MET 404	FLUID MECHANICS AND HYDRAULIC MACHINES	5			10	20	30	70			100
5.	EET 421	ELECTRICAL TECHNOLOGY	4			10	20	30	70			100
PRACTICAL/TERM WORK												
5.	MEP 401	FLUID MECHANICS AND HYDRAULIC MACHINES LAB			6					25	75	100
6.	EEP 421	ELECTRICAL LABORATORY PRACTICE			6					25	50	75
7.	MEP 402	WORK SHOP PRACTICE-III			6					25	50	75
GRAND TOTAL			**21**		**18**	**50**	**100**	**150**	**350**	**75**	**175**	**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%

THEORY OF MACHINES

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	MET 401	Semester	4th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Tutorial:		Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

Course Objectives

Students will develop an ability towards

- Understanding machine as a system consisting of different link assemblies as components
- Comprehending Working principle of machine components such as clutch, brakes, bearings based on friction
- Comprehending working principles related to power transmission systems and predicting the work involved and efficiency
- Comprehending working principles in speed and torque regulating devices such as governor and flywheels
- Determination of amount and position of masses required towards static and dynamic balancing
- Comprehending types and causes of vibration in machines and predicting remedial measures

1.0 Simple mechanism

1.1 Link, kinematic chain, mechanism, machine 8

1.2 Inversion, four bar link mechanism and its inversion

1.3 Lower pair and higher pair

1.4 Cam and followers

2.0 Friction **12**

2.1 Revision of topic previously taught
2.2 Friction between nut and screw for square thread, screw jack
2.3 Bearing and its classification, Description of roller, needle roller & ball bearings.
2.4 Torque transmission in flat pivot & conical pivot bearings.
2.5 Flat collar bearing of single and multiple types.
2.6 Torque transmission for single and multiple clutches
2.7 Working of simple frictional brakes.
2.8 Working of Absorption type of dynamometer

3.0 Power Transmission 12

3.1 Concept of power transmission
3.2 Type of drives, belt, gear and chain drive.
3.3 Computation of velocity ratio, length of belts (open&cross) with and without slip.
3.4 Ratio of belt tensions, centrifugal tension and initial tension.
3.5 Power transmitted by the belt.
3.6 V-belts and V-belts pulleys.
3.7 Concept of crowning of pulleys.
3.8 Gear drives and its terminology.
3.9 Gear trains, Working principle of simple, compound, reverted and epicyclic gear trains.

4.0 **Governors and Flywheel** 12

4.1 Function of governor
4.2 Classification of governor
4.3 Working of Watt, Porter, Proel and Hartnel l governors.
4.4 Conceptual explanation of sensitivity, stability and isochronism .

4.5 Function of flywheel.
4.6 Comparison between flywheel & governor.
4.7 Fluctuation of energy and coefficient of fluctuation of speed.

5.0 **Balancing of Machine** 8

5.1 Concept of static and dynamic balancing.
5.2 Static balancing of rotating parts.
5.3 Principles of balancing of reciprocating parts.
5.4 Causes and effect of unbalance.
5.5 Difference between static and dynamic balancing

6.0 Vibration of machine parts 8

6.1 Introduction to Vibration and related terms (Amplitude, time period and frequency, cycle)
6.2 Classification of vibration.
6.3 Basic concept of natural, forced & damped vibration
6.4 Torsional and Longitudinal vibration.
6.6 Causes & remedies of vibration.

Learning Resources:

Text Books

Theory of Machines by R S Khrmi
Theory of Machines by R K Rajput
Theory of Machines by S R Rattan

Reference Book

Theory of Machines by P L Ballaney

MANUFACTURING TECHNOLOGY

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	MET 402	Semester	4th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Tutorial:		Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

Course Objectives

Students will develop an ability towards

- Comprehending required material properties for cutting tools
- Comprehending machining mechanism principle and factors affecting machining performance
- Comprehending working principle and components in machining tools including lathe, milling, shaping, planning, slotting machines
- Comprehending requirement of surface finish and realize principles involved in grinding and super finishing operations

1.0 Tool Materials

1.1 Composition of various tool materials 4

1.2 Physical properties & uses of such tool materials.

2.0 Cutting Tools 6

2.1 Cutting action of various hand tools such as Chisel, hack saw blade, dies and reamer

2.3 Turning tool geometry and purpose of tool angle

2.5 Machining process parameters (Speed, feed and depth of cut)

2.6 Coolants and lubricants in machining and purpose

3.0 Lathe Machine 8

3.1 Construction and working of lathe

- Major components of a lathe and their function
- Operations carried out in a lathe (Turning, thread cutting, taper turning, internal machining, parting off, facing, knurling)
- Safety measures during machining

3.2 Capstan lathe

- Difference with respect to engine lathe
- Major components and their function
- Define multiple tool holders

3.3 Turret Lathe

- Difference with respect to capstan lathe
- Major components and their function

3.6 Draw the tooling lay out for preparation of a hexagonal bolt & bush

4.0 Shaper 6

4.1 Potential application areas of a shaper machine

4.2 Major components and their function

4.3 Explain the automatic table feed mechanism

4.4 Explain the construction & working of tool head

4.5 Explain the quick return mechanism through sketch

4.6 State the specification of a shaping machine.

5.0 Planning Machine 6

5.1 Application area of a planar and its difference with respect to shaper

5.2 Major components and their functions

5.3 The table drive mechanism

5.4 Working of tool and tool support

5.5 Clamping of work through sketch.

6.0 Milling Machine 8

6.1 Types of milling machine and operations performed by them

6.2 Explain work holding attachment
6.3 Construction & working of simple dividing head, universal dividing head
6.4 Procedure of simple and compound indexing
6.7 Illustration of different indexing methods

7.0 Slotter 6

7.1 Major components and their function
7.2 Construction and working of slotter machine
7.3 Tools used in slotter

8.0 Grinding 6

8.1 Significance of grinding operations
8.2 Manufacturing of grinding wheels
8.3 Criteria for selecting of grinding wheels
8.4 Specification of grinding wheels with example
Working of
- Cylindrical Grinder
- Surface Grinder
- Centre less Grinder

9.0 Internal Machining operations 6

Classification of drilling machines
9.1 Working of
- Bench drilling machine
- Pillar drilling machine
- Radial drilling machine

9.2 Boring
- Basic Principle of Boring
- Different between Boring and drilling

9.3 Broaching
- Types of Broaching (pull type, push type)
- Advantages of Broaching and applications

10.0 Surface finish, lapping 4

10.1 Definition of Surface finish
- Define super finishing

10.2 Description of lapping & explain their specific cutting.

Learning Resources:

Text Books

1. Work shop Technology by Hazra Choudhary Vol.-I, Vol.-II
2. Manufacturing Technology by P. N. Rao, Vol.- I, Vol.- II

Reference Books

1. Work shop Technology Part-I & II by W.A.S Chapman

THERMAL ENGINEERING-II

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	MET 403	Semester	4th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Tutorial:		Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

Course Objectives:

- Students will develop an ability towards
- Comprehending major theoretical cyclic processes using vapor and gas as working substances and computing work done and efficiencies thereof.
- Comprehending heat transfer modes and computing heat transferred through conduction, convection and radiation from simple structures.
- Comprehending refrigeration cycles in practice and computing coefficient ofm performance and efficiencies.

Chapter	Topics	Contents	Hours
1.	**Vapor Power Cycles**		12
	1.1	Steam power plant lay out	
	1.2	Steam power plant cycle	
	1.3	Carnot vapor cycle	
	1.4	Rankine vapor cycle	
	1.5	Modifications to Rankine vapor cycles	
	1.6	Qualities of ideal working fluid for vapor power cycle	
	1.7	Binary vapor cycles	
2	**Gas Power cycles**		12
	2.1	Concept of IC Engine	
	2.2	Otto cycle	
	2.3	Diesel cycle	
	2.4	Dual cycle	
	2.5	Comparison of Otto, Diesel and dual cycles	
	2.6	2S and 4S engines and differences thereof	
3	**Fuels and Combustion**		10
	3.1	Hydrocarbon fuels	
	3.2	Combustion reactions (Explanation only), concept of stoichiometric combustion, complete combustion and incomplete combustion	
	3.3	Enthalpy of formation, enthalpy of reaction	
	3.4	Heating values for fuels	
	3.5	Quality of IC Engine fuels: Octane Number and Cetane number	
4	**Heat Transfer**		16
	4.1	Modes of heat transfer	
	4.2	Fourier law of heat conduction, thermal conductivity	
	4.3	Steady state heat conduction in solids (Plane wall, hollow cylinder, hollow sphere)	
	4.4	Convective heat transfer, Newton's law of cooling	
	4.5	Radiation heat transfer, Stefan Boltzman Law	
	4.6	Theories of radiation: Maxwell's theory, Max Planck's theory; Black body radiation	
	4.7	Surface absorption, reflection and transmission	
	4.8	Kirchoff's law relating to spectral emissive power to absoptivity	
	4.9	Heat exchangers: concept, application and classification	
5	**Refrigeration cycles**		10
	5.1	Concept of refrigerators and heat pumps	
	5.2	Reversed Carnot cycle and its limitations	
	5.3	Ideal vapor compression refrigeration cycle	

5.4 Actual vapor compression refrigeration cycle
5.5 Gas refrigeration cycle

Learning Resources:

Text Books: Engineering Thermodynamics, P. Chattopadhyay
Thermal Engineering: Mahesh M Rathore

FLUID MECHANICS AND HYDRAULIC MACHINES

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	MET 404	Semester	4th
Total Period:	75	Examination	3 hrs
Theory periods:	5 P/W	Class Test:	20
Tutorial:		Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

Course Objectives

Students will develop an ability towards

- Comprehending fluid properties and their measurements
- Realizing conditions for floatation
- Applying Bernoulli's theorem
- Determining work done and efficiency in hydraulic machines

1.0 Properties of Fluid

1.1 Definitions and Units of Density, Specific weight, specific gravity, specific volume 5

1.2 Definitions and Units of Dynamic viscosity, kinematic viscosity, surface tension Capillary phenomenon

2.0 Fluid Pressure and its measurements **8**

2.1 Definitions and units of fluid pressure, pressure intensity and pressure head

2.2 Concept of atmospheric pressure, gauge pressure, vacuum pressure and absolute pressure

2.3 Pressure measuring instruments
Manometers: Simple and differential
Bourden tube pressure gauge
(Simple Numerical)

3.0 Hydrostatics 8

3.1 Definition of hydrostatic pressure

3.2 Total pressure and centre of pressure on immersed bodies
(Simple Numericals)

3.3 Archimedis' principle, concept of buoyancy, metacentre and metacentric height

3.4 Concept of floatation

4.0 Fluid Flow 10

4.1 Types of fluid flow

4.2 Continuity equation (Statement and proof for one dimensional flow)

4.3 Bernoulli's theorem (Statement and proof)
Applications and limitations of Bernoulli's theorem (Venturi meter, pitot tube)
(Simple Numericals)

4.4 Definition of orifices, Orifice coefficients (Cc, Cv, Cd and relation among them)

5.0 Flow through pipe 10

5.1 Definition of pipe, laws of fluid friction

5.2 Head loss due to friction: Darcy's and Chezy's formula)

5.3 Hydraulic gradient and total gradient line

6.0 Impact of jets 10

6.1 Impact of jet on fixed and moving vertical flat plates, derivation of work done on series of vanes and condition for maximum efficiency

6.2 Impact of jet on moving curved vanes, illustration using velocity triangles, derivation of work done, efficiency
(Simple Numericals)

7.0 Hydraulic turbines 12

7.1 Layout and features of hydroelectric power plant

7.2 Definition and classification of hydraulic turbines

7.3 Construction and working principle of Impulse turbine (Pelton wheel)

Velocity triangle of a single bucket, work done and efficiency in Pelton wheel (Numerical Problems)

7.4 Construction and working principle of Reaction turbine (Francis turbine)
Velocity triangle, work done and efficiency
(Numerical Problems)
Construction and working principle of Kaplan turbine

8.0 Hydraulic Pumps 12

8.1 Definition and classification of pumps

8.2 Centrifugal Pumps
Construction and working principles, velocity diagram of a single impeller, work done and efficiency (Numerical Problems)
Concept of multistage centrifugal pumps
Cavitation-Causes and its effect

8.3 Reciprocating Pumps
Construction and working principle of single acting and double acting reciprocating pumps

8.4 Concept of slip and negative slip

Learning Resources:

	Title of Book	Author
Text Books:		
	Fluid Mechanics and Hydraulic Machines	R K Bansal
	Hydraulics, Fluid mechanics and Fluid machines	S Ramamrutham
Reference	Hydraulics and fluid mechanics including hydraulic machines	Modi and Seth
	Fluid Mechanics and Machinery	C S P Ojha, R Berndtsson, P N Chandramouli

ELECTRICAL TECHNOLOGY

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	EET 421	Semester	4th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Tutorial:		Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

Course Objectives

Students will develop an ability towards

- Understanding of fundamentals related to electrical power generation, transmission, distribution and utilization
- Comprehending construction and working principles of electrical machines including AC motor, DC motor, alternator and AC machines
- Realization of electrical drives in industrial establishments

Comprehending application of electrical machines in manufacturing and farming sector

1.0	Introduction to Electrical Power supply system generation, transmission, Distribution and Utilization. AC Supply and DC Supply	4
2.0	**Three phase supply:** Star and Delta circuit, Line and Phase relationship, power equation with numerical problems	6
3.0	**Measuring Instruments:** Introduction to construction, operation and use of AC and DC ammeter, voltmeter, electrodynamic Watt meter, energy meter and digital multimeter, Clip on motor	8
4.0	**DC Motor:** Construction and principle of operation, Speed and torque characteristics. Types, specifications and ratings and applications, types of insulation used with numerical problems	8
5.0	**AC Machines:** **Transformer:** Construction and principle of operation, emf equation and transformation ratio, Load test, efficiency and regulation, Specifications and rating. Auto transformer and 3-phase transformer concept only. Applications of transformers with numerical problems	8
6.0	**AC Motor:** Construction and principles of operation of 3 phase induction motor, Speed torque characteristics, slip, speed control (V/f), reversal of rotation, starters. Single phase motor, Universal motor, stepper motor & servo motor. Motor specification & ratings. Applications of these motors in various fields	8
7.0	**Alternator:** Construction, principles of operation and applications. Self and separate excitation. **Synchronous Motor:** Construction, principles of operation, methods of starting and applications with numerical problems.	8
8.0	**Industrial applications:** Classification of drives, factors for selection of motor for different drives, Enclosures and Mountings	4
9.0	**Electric heating and welding:** Working principles and types selection of the system, specifications and rating	4
10.0	**Electrometallurgical and Eletctro Agro systems:** Concept and principle used in electroplating. Electrical machines in electro-agro systems (Irrigation pumps)	2

Learning Resources:

	Text Book: Electrical Technology, E. Hughes, ELBS Publications Electrical Technology, H Cotton, Pitman Publications Electrical Technology, Vol1-4, B L Thereja, S. Chand Publications	

FLUID MECHANICS AND HYDRAULIC MACHINES LAB

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	MEP 401	Semester	4th
Total Period:	90	Examination	4 hrs
Lab. periods:	6 P/W	Term Work	25
Maximum marks:	100	End Semester Examination:	75

Course Objectives:

Students will develop an ability towards

- Measure pressure using different pressure measuring instruments
- Experimentally verify Bernoulli's theorem
- Determination of hydraulic coefficients

Performance evaluation in hydraulic machines

Sr No	Content
1	Study of pressure measuring devices (manometer, Bourdon tube pressure gaguge)
2	Verification of Bernoulli's theorem
3	Determination of Cd from venturimeter
4	Determination of Cc, Cv, Cd from orifice meter
5	Determine of Darcy's coefficient from flow through pipe
6	Performance test in impulse turbine
7	Study of dissected models of turbines and pumps
8.	Performance test in reaction turbine
9.	Performance test in centrifugal pump
10.	Performance test in reciprocating pump

ELECTRICAL LABORATORY PRACTICE

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	EEP 421	Semester	4th
Total Period:	90	Examination	4 hrs
Lab. periods:	6 P/W	Term Work	25
Maximum marks:	75	End Semester Examination:	50

Course Objectives

Students will develop an ability towards

- Observe and identify electrical components
- Measuring earth resistance
- Operation and performance measurement of electrical machines

Sr No	Content
1	Study of different parts and identification of terminals and testing of insulation resistance of a DC machine
2	Study of 3 point and 4 point starter
3	Speed variation of DC motor by field control and armature voltage control method
4	Identification of terminals and determination of transformation ratio of a single phase transformer.
5	Determination of regulation of transformer by direct loadings
6	Measurement of earth resistance of an earthing installation
7	Study of PMMC & MI type instrument
8.	Start and run of a 3-phase induction rotor by Star-Delta
9.	Connect and run an alternator and starter, measure the terminal voltage on different load condition
10.	Start and run a synchronous motor and measure its speed at no load

WORK SHOP PRACTICE-III

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	MEP 402	Semester	4th
Total Period:	90	Examination	4 hrs
Lab. periods:	6 P/W	Term Work	25
Maximum marks:	75	End Semester Examination:	50

Course Objectives:

Students will develop an ability towards

- Preparing components and jobs using foundry, welding and machining
- Realizing process parameters involved and their effects

1. Foundry Practices

1.1 Preparation of simple moulds

1.2 Preparation of cores

1.3 Job involving ferrous/non ferrous casting

2. Welding Practices

2.1 Butt joint through Arc welding

2.2 Lap joint through Gas welding

2.3 Joining two non-ferrous parts through TIG/MIG

3 Machining Practices

3.1 Job involving drilling, boring

3.2 Internal threading

3.3 Job involving use of Capstan turret lathe