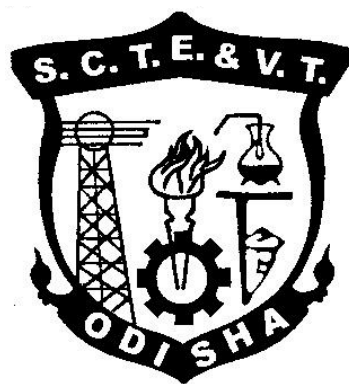


CURRICULLUM OF 5TH SEMESTER

For

DIPLOMA IN MECHANICAL ENGINEERING

(Effective FROM 2020-21 Sessions)



**STATE COUNCIL FOR TECHNICAL EDUCATION & VOCATIONAL TRAINING,
ODISHA, BHUBANESWAR**

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

TEACHING AND EVALUATION SCHEME FOR 5th Semester (Mechanical.)(PT) (wef 2020-21)

Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
Theory									
Th.1		Entrepreneurship and Management & Smart Technology	4		-	20	80	3	100
Th.2		Theory of Machine	4		-	20	80	3	100
Th.3		Manufacturing Technology	4		-	20	80	3	100
Th.4		Thermal Engg-II	4	1		20	80	3	100
		<i>Total</i>	16	1		80	320	-	400
Practical									
Pr.1		Theory of Machine and Measurement lab	-	-	6	50	100	3	150
Pr.2		Mechanical Engg. Lab-II	-	-	6	25	50	3	75
		Student Centered Activities (SCA)			3				
		<i>Total</i>	-	-	15	75	150	-	225
		Grand Total	16	1	15	155	470	-	625

Abbreviations: L-Lecturer, T-Tutorial, P-Practical. Each class is of minimum 55 minutes duration

Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%

SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM etc. ,Seminar and SCA shall be conducted in a section.

There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester

Th1. ENTREPRENEURSHIP and MANAGEMENT & SMART TECHNOLOGY
(Common to All Branches)

Theory	4 Periods per week	Internal Assessment	20 Marks
Total Periods	60 Periods	End Sem Exam	80 Marks
Examination	3hours	Total Marks	100Marks

Topic Wise Distribution of Periods

Sl No.	Topic	Periods
1	Entrepreneurship	10
2	Market Survey and Opportunity Identification(Business Planning)	8
3	Project report Preparation	4
4	Management Principles	5
5	Functional Areas of Management	10
6	Leadership and Motivation	6
7	Work Culture, TQM & Safety	5
8	Legislation	6
9	Smart Technology	6
	TOTAL	60

RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students, so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. It may be further added that an entrepreneurial mind set with managerial skill helps the student in the job market. The students can also be introduced with Startup and Smart Technology concept, which shall radically change the working environment in the coming days in the face of Industry 4.0

In this subject, the Students shall be introduced/ exposed to different concepts and Terminologies in brief only, so that he/she can have broad idea about different concepts/items taught in this subject. Solving numerical problem on any topic/item is beyond the scope of this subject.

OBJECTIVES

After undergoing this course, the students will be able to :

- Know about Entrepreneurship, Types of Industries and Startups
- Know about various schemes of assistance by entrepreneurial support agencies
- Conduct market survey
- Prepare project report
- know the management Principles and functional areas of management
- Inculcate leadership qualities to motivate self and others.
- Maintain and be a part of healthy work culture in an organisation.
- Use modern concepts like TQM
- Know the General Safety Rules
- Know about IOT and its Application in SMART Environment.

DETAILED CONTENTS

1. **Entrepreneurship**

- Concept /Meaning of Entrepreneurship
- Need of Entrepreneurship
- Characteristics, Qualities and Types of entrepreneur, Functions
- Barriers in entrepreneurship
- Entrepreneurs vrs. Manager
- Forms of Business Ownership: Sole proprietorship, partnership forms and others
- Types of Industries, Concept of Start-ups
- Entrepreneurial support agencies at National, State, District Level(Sources): DIC, NSIC,OSIC, SIDBI, NABARD, Commercial Banks, KVIC etc.
- Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks

2. **Market Survey and Opportunity Identification (Business Planning)**

- Business Planning
- SSI, Ancillary Units, Tiny Units, Service sector Units
- Time schedule Plan, Agencies to be contacted for Project Implementation
- Assessment of Demand and supply and Potential areas of Growth
- Identifying Business Opportunity
- Final Product selection

3. **Project report Preparation**

- Preliminary project report
- Detailed project report, Techno economic Feasibility
- Project Viability

4. **Management Principles**

- Definitions of management
- Principles of management
- Functions of management (planning, organising, staffing, directing and controlling etc.)
- Level of Management in an Organisation

5. **Functional Areas of Management**

- a) Production management
 - Functions, Activities
 - Productivity
 - Quality control
 - Production Planning and control
- b) Inventory Management
 - Need for Inventory management
 - Models/Techniques of Inventory management
- c) Financial Management
 - Functions of Financial management
 - Management of Working capital
 - Costing (only concept)
 - Break even Analysis
 - Brief idea about Accounting Terminologies: Book Keeping, Journal entry, Petty Cash book, P&L Accounts, Balance Sheets(only Concepts)
- d) Marketing Management
 - Concept of Marketing and Marketing Management
 - Marketing Techniques (only concepts)
 - Concept of 4P s (Price, Place, Product, Promotion)
- e) Human Resource Management
 - Functions of Personnel Management

- Manpower Planning, Recruitment, Sources of manpower, Selection process, Method of Testing, Methods of Training & Development, Payment of Wages
6. **Leadership and Motivation**
- a) Leadership
 - Definition and Need/Importance
 - Qualities and functions of a leader
 - Manager Vs Leader
 - Style of Leadership (Autocratic, Democratic, Participative)
 - b) Motivation
 - Definition and characteristics
 - Importance of motivation
 - Factors affecting motivation
 - Theories of motivation (Maslow)
 - Methods of Improving Motivation
 - Importance of Communication in Business
 - Types and Barriers of Communication
7. **Work Culture, TQM & Safety**
- Human relationship and Performance in Organization
 - Relations with Peers, Superiors and Subordinates
 - TQM concepts: Quality Policy, Quality Management, Quality system
 - Accidents and Safety, Cause, preventive measures, General Safety Rules , Personal Protection Equipment(PPE)
8. **Legislation**
- a) Intellectual Property Rights(IPR), Patents, Trademarks, Copyrights
 - b) Features of Factories Act 1948 with Amendment (only salient points)
 - c) Features of Payment of Wages Act 1936 (only salient points)
9. **Smart Technology**
- Concept of IOT, How IOT works
 - Components of IOT, Characteristics of IOT, Categories of IOT
 - Applications of IOT- Smart Cities, Smart Transportation, Smart Home, Smart Healthcare, Smart Industry, Smart Agriculture, Smart Energy Management etc.

Syllabus to be covered before IA: Chapter 1,2,3,4

RECOMMENDED BOOKS

1. Entrepreneurship Development and Management by R.K Singhal, Katson Books., New Delhi
2. Entrepreneurship Development and Management by U Saroj and V Mahendiratta, Abhishek Publications, Chandigarh
3. Entrepreneurship Development and Management by Vasant Desai, Himalaya Pub.House
4. Industrial Engineering and Management by O.P Khanna ,Dhanpat Rai and Sons
5. Industrial Engineering and Management by Banga and Sharma, Khanna Publications
6. Internet of Things by Jeeva Jose, Khanna Publications, New Delhi
7. Online Resource on Startups and other concepts
8. <https://www.fundable.com/learn/resources/guides/startup>

TH 2 - THEORY OF MACHINES

Name of the Course: Diploma in Mech(PT)			
Course code:		Semester	5th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Maximum marks:	100	End Semester Examination:	80

A.RATIONAL:

Mechanical and Automobile engineering is involved with design, manufacturing and use of various types of machines. Each machine consists of a large number of static and moving parts called mechanisms. Theory of machines is study of such different kind of mechanisms.

B.COURSE OBJECTIVES:

Students will develop an ability towards

- Understanding machine 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 principle 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

C. TOPIC WISE DISTRIBUTION OF PERIODS

<u>Sl. No.</u>	<u>Topic</u>	<u>Periods</u>
01	Simple Mechanism	08
02	Friction	12
03	Power Transmission	12
04	Governors and Flywheel	12
05	Balancing of Machine	08
06	Vibration of machine parts	08
	Total Period:	60

D. CONTENT

1.0 Simple mechanism

- 1.1 Link ,kinematic chain, mechanism, machine
- 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

- 2.1 Friction between nut and screw for square thread, screw jack
- 2.2 Bearing and its classification, Description of roller, needle roller& ball bearings.
- 2.3 Torque transmission in flat pivot& conical pivot bearings.
- 2.4 Flat collar bearing of single and multiple types.

- 2.5 Torque transmission for single and multiple clutches
- 2.6 Working of simple frictional brakes.
- 2.7 Working of Absorption type of dynamometer

3.0 Power Transmission

- 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 and 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 Determine belt thickness and width for given permissible stress for open and crossed belt considering centrifugal tension.
- 3.7 V-belts and V-belts pulleys.
- 3.8 Concept of crowning of pulleys.
- 3.9 Gear drives and its terminology.
- 3.10 Gear trains, working principle of simple, compound, reverted and epicyclic gear trains.

4.0 Governors and Flywheel

- 4.1 Function of governor
- 4.2 Classification of governor
- 4.3 Working of Watt, Porter, Proel and Hartnell governors.
- 4.4 Conceptual explanation of sensitivity, stability and isochronisms.
- 4.5 Function of flywheel.
- 4.6 Comparison between flywheel &governor.
- 4.7 Fluctuation of energy and coefficient of fluctuation of speed.
- 4.8

5.0 Balancing of Machine

- 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

- 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.
- 6.5 Causes & remedies of vibration.

CHAPTERS COVERED UP TO IA- 1,2,3

Learning Resources:

SI No.	Name of the Book	Author Name	Publisher
1.	Text Book of Theory of Machine	R.S Khurmi	S.Chand
2.	Text Book of Theory of Machine	R.K. Rajput	S.Chand
3.	Text Book of Theory of Machine	P.L.Ballany	Dhanpat Rai
4.	Text Book of Theory of Machine	Thomas Bevan	Pearsion

TH-3 MANUFACTURING TECHNOLOGY

Name of the Course: Diploma in Mech(PT)			
Course code:		Semester	5th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONAL:

Engineering basically means production 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 most important subjects to be learned by a mechanical and automobile engineer.

B. 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, planing, slotting machines
- Comprehending requirement of surface finish and realize principles involved in grinding and superfinishing operations

C. TOPIC WISE DISTRIBUTION OF PERIODS

<u>Sl. No.</u>	<u>Topic</u>	<u>Periods</u>
01	Tool Materials	04
02	Cutting Tools	06
03	Lathe Machine	08
04	Shaper	06
05	Planing Machine	06
06	Milling Machine	08
07	Slotter	06
08	Grinding	06
09	Internal Machining operations	06
10	Surface finish, lapping	04
	Total Period:	60

D. CONTENT

1.0 Tool Materials

- 1.1 Composition of various tool materials
- 1.2 Physical properties & uses of such tool materials.

2.1 Cutting Tools

- 2.1 Cutting action of various and tools such as Chisel, hacksaw 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

- 3.1 Construction and working of lathe and CNC 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
- 3.4 Draw the tooling layout for preparation of a hexagonal bolt &bush

4.0 Shaper

- 4.1 Potential application areas of a shaper machine
- 4.2 Major components and their function
- 4.3 Explain the automatic able 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

- 5.1 Application area of a planer 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

- 6.1 Types of milling machine and operations performed by them and also same for CNC milling machine
- 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
- 6.5 Illustration of different indexing methods

7.0 Slotter

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

8.0 Grinding

- 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
 - Centreless Grinder

9.0 Internal Machining operations

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 Surface finish, lapping

10.1 Definition of Surface finish

10.2 Description of lapping& explain their specific cutting.

CHAPTERS COVERED UP TO IA- 1, 2,3,4,5

LearningResources:

Sl No.	Name of the Book	Author Name	Publisher
1.	Text Book of Workshop Technology	Hazra Choudhury Vol- I & II	MPP Pvt. Ltd.
2.	Text Book of Workshop Technology	W.A.S Chapman Vol-I & II	
3.	Text Book of Manufacturing Process	P.N Rao	TMH

TH 4 -THERMAL ENGINEERING-II

Name of the Course: Diploma in Mech(PT)			
Course code:		Semester	5th
Total Period:	60	Examination	3 hr
Theory periods:	4 P/week	Class Test:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONAL:

Modern society needs lots of applications of thermodynamics, which deals with energy possessed by hot vapors, its production and its application in different fields.

B. COURSE OBJECTIVES:

Student will develop ability towards.

- Understanding the power developed in I.C engine and efficiency.
- Understanding the principle, performance and application of air compressor.
- Determining thermodynamic properties of steam using steam tables & mollier chart.
- Comprehending the working of various steam generators i.e. boilers.
- Comprehending the vapor power cycles and computing work done & efficiencies thereof.

C. TOPIC WISE DISTRIBUTION OF PERIODS

<u>Sl. No.</u>	<u>Topic</u>	<u>Periods</u>
01	Performance of I. C engine	08
02	Air Compressor	12
03	Properties of steam	12
04	Steam Generator	12
05	Vapor power cycle	08
06	Heat Transfer	08
Total Period:		60

D.CONTENT

1. Performance of I.C engine

1.1 Define mechanical efficiency, Indicated thermal efficiency,

Relative Efficiency, brake thermal efficiency overall efficiency

Mean effective pressure & specific fuel consumption.

1.2 Define air-fuel ratio & calorific value of fuel.

1.3 Work out problems to determine efficiencies & specific fuel consumption.

2. Air Compressor

- 2.1 Explain functions of compressor & industrial use of compressor air
- 2.2 Classify air compressor & principle of operation.
- 2.3 Describe the parts and working principle of reciprocating Air compressor.
- 2.4 Explain the terminology of reciprocating compressor such as bore, stroke, pressure ratio free air delivered & Volumetric efficiency.
- 2.5 Derive the work done of single stage & two stage compressor with and without clearance.
- 2.6 Solve simple problems (without clearance only)

3. Properties of Steam

- 3.1 Difference between gas & vapours.
- 3.2 Formation of steam.
- 3.3 Representation on P-V, T-S, H-S, & T-H diagram.
- 3.4 Definition & Properties of Steam.
- 3.5 Use of steam table & mollier chart for finding unknown properties.
- 3.6 Non flow & flow process of vapour.
- 3.7 P-V, T-S & H-S, diagram.
- 3.8 Determine the changes in properties & solve simple numerical.

4. Steam Generator

- 4.1 Classification & types of Boiler.
- 4.2 Important terms for Boiler.
- 4.3 Comparison between fire tube & Water tube Boiler.
- 4.4 Description & working of common boilers (Cochran, Lancashire, Babcock & Wilcox Boiler)
- 4.5 Boiler Draught (Forced, induced & balanced)
- 4.6 Boiler mountings & accessories.

5. Steam Power Cycles

- 5.1 Carnot cycle with vapour.
- 5.2 Derive work & efficiency of the cycle.
- 5.3 Rankine cycle.
 - 5.3.1 Representation in P-V, T-S & h-s diagram.
 - 5.3.2 Derive Work & Efficiency.
 - 5.3.3 Effect of Various end conditions in Rankine cycle.
 - 5.3.4 Reheat cycle & regenerative Cycle.
- 5.4 Solve simple numerical on Carnot vapour Cycle & Rankine Cycle.

6. Heat Transfer

6.1 Modes of Heat Transfer (Conduction, Convection, Radiation).

6.2 Fourier law of heat conduction and thermal conductivity (k).

6.3 Newton's laws of cooling.

6.4 Radiation heat transfer (Stefan, Boltzmann & Kirchhoff's law) only statement, no derivation & no numerical problem.

6.5 Black body Radiation, Definition of Emissivity, absorptivity, & transmissibility.

CHAPTERS COVERED UP TO IA- 1, 2,3.

<u>Sl No.</u>	<u>Reference Book</u>	<u>Author Name</u>	<u>Publisher Name</u>
1	Thermal Engineering	R.S. Khurmi	S.Chand
2	Thermal Engineering	A.R.Basu	Dhanpat Rai
3	Thermal Engineering	A.S. Sarao	Satya Prakash
4	Engineering Thermodynamics	P.k.Nag	TMH
5	Thermal Engineering	Mahesh M Rathore	TMH

PR-1 THEORY OF MACHINES AND MEASUREMENTS LAB

	Name of the Course : Diploma in Mech(PT)		
Course code:		Semester	5th
Total Period:	90	Examination	3 hrs
Lab. periods:	6 P/W	Term Work	50
Maximum marks:	150	End Semester Examination:	100

SL. No Content

- 1 Determination of centrifugal force of a governor (Hart Nell / Watt/Porter).
- 2 Study & demonstration of static balancing apparatus.
- 3 Study & demonstration of journal bearing apparatus.
- 4 Study of different types of Cam and followers.
- 5 Study & demonstration of epicyclic gear train.
- 6 Determination of the thickness of ground M.S flat to an accuracy of 0.02mm using Vernier Caliper.
- 7 Determination of diameter of a cylindrical component to an accuracy of 0.01mm using micrometer.
8. Determine the heights of gauge blocks or parallel bars to accuracy of 0.02mm using Vernier height gauge.
9. Determine the thickness of ground MS plates using slip gauges.
10. Determination of angel of Machined surfaces of components using sin bar with slip gauges.

PR- 2 MECHANICAL ENGG. LAB –II

Name of the Course: Diploma in **Mech(PT)**

Course code		Semester	5th
Total Period:	90	Examination	3 hrs
Lab. periods:	6 P/W	Term Work	25
Maximum marks:	75	End Sem Examination:	50

SL. No	Content
1	Study of 2-S, 4-S petrol & diesel engine models
2	Determine the brake thermal efficiency of single cylinder petrol engine.
3	Determine the brake thermal efficiency of single cylinder diesel engine.
4	Determine the B.H.P, I.H.P BSFC of a multi cylinder engine by Morse test.
5	Determine the mechanical efficiency of an air Compressor.
6	Study of pressure measuring devices (manometer, Bourdon tube pressure gauge)
7	Verification of Bernoulli's theorem
8	Determination of Cd from venturimeter
9	Determination of Cc, Cv, Cd from orifice meter
10	Determine of Darcy's coefficient from flow through pipe

List of Equipments of Theory of Machine and Measurement Lab

Sl. No.	Name of Apparatus	QUANTITY
01	GOVERNOR APPARATUS	01No
02	STATIC AND DYNAMIC APPARATUS	01No
03	JOURNAL BEARING APPARATUS	01 No
04	CAM ANALYSIS APPARATUS	01 No
05	EPICYCLIC GEAR TRAIN	01 No
06	VERNIER CALLIPER	04 Nos.
07	MICROMETER	04 Nos.
08	VERNIER HEIGHT GAUGE	02 Nos.
09	SLIP GAUGE	02 Nos.
10	SINE BAR	02 Nos.

List of Equipments of Workshop Practice-III

Sl. No.	Name of Apparatus	QUANTITY
01	RADIAL DRILL MACHINE	01 No
02	ALL GEAR LATHE	06 Nos.
03	CAPSTAN LATHE	01 Nos.
04	CNC LATHE TRAINER	01 Nos.

List of Equipments of MEL-II

SL. NO.	NAME OF ITEM	QUANTITY
01	MODEL OF 2 STROKE PETROL ENGINE	02 Nos
02	MODEL OF 4 STROKE PETROL ENGINE	02 Nos.
03	MODEL OF 2 STROKE DIESEL ENGINE	02 Nos.
04	MODEL OF 4 STROKE DIESEL ENGINE	02Nos.
05	SINGLE CYLINDER PETROL ENGINE TEST RIG	01 No.
06	SINGLE CYLINDER DIESEL ENGINE TEST RIG	01 No.
07	MORSE TEST APPARATUS	01 No.
08	2 STAGE AIR COMPRESSOR TEST RIG	01 No.
09	PRESSURE MEASURING DEVICES (BOURDON TUBE PRESSURE GAUGE, MANOMETER)	02 Nos. each
10	BERNOULLI'S APPARATUS	01 No.
11	VENTURIMETER APPARATUS	01 No.
12	ORIFICEMETER APPARATUS	01 No
13	FLOW THROUGH PIPE APPARATUS	01 No