Veermata Jijabai Technological Institute (V.J.T.I)

(Central Technological Institute, Maharashtra State, INDIA)

H. R. Mahajani Marg, Matunga, Mumbai 400019

Tel. No. +91 22 24198101-02 Fax: +91 22 24102874 Website: www.vjti.ac.in

Programme Name: Diploma In Mechanical Engineering

Programme Code	**: DME**	**With Effect from Academic Year**	**: 2025-26**
Duration of Programme	**: 6 Semester**	**Duration**	**: 16 Weeks**
Semester	**: Sixth**	**Scheme**	**: R-2023**

Sr No	Course Title	Abbreviation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme													
						Actual Contact Hrs./Week			Self-Learning (Term Work + Assignment)	Notional Learning Hours /Week		Paper Duration (hrs.)	Theory					Based on LL & TL Practical				Based on Self Learning SLA		Total Marks
						CL	TL	LL					FA-TH (MST)	SA-TH (ESE)		Total		FA-(CA)		SA-PR (PR/OR)				
													Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
1	MACHINE DESIGN	MD	DSC	234ME61	-	4	-	2	2	8	4	3	30	70	28	100	40	25	10	25#	10	25	10	175
2	REFRIGERATION AND AIR CONDITIONING	RAC	DSC	234ME62	-	4	-	2	2	8	4	3	30	70	28	100	40	25	10	25#	10	25	10	175
3	INDUSTRIAL MANAGEMENT	IM	AEC	234ME63	-	4	-	2		6	3	3	30	70	28	100	40	25	10	25#	10	-	-	150
4	ELECTIVE – II	-	DSE	234ME64	-	3	-	2	-	5	2.5	3	30	70	28	100	40	25	10	25#	10	-	-	150
5	ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS	EDS	VEC	234ME65	-	1	1	2		4	2	-	-	-		-	-	25	10	25#	10	-	-	50
6	COMPUTER PROGRAMMING (PYTHON)	CP	SEC	234ME56	-	1	-	2	-	3	1.5		-	-		-	-	25	10	25#	10	-	-	50
7	PROJECT- II	PJT-II	SEC	234ME67	-	-	-	6	-	6	3	-	-	-		-	-	100	40	100#	40	-	-	200
Total					-	17	1	18	4	40	20		120	280		400		250		250		50		950

Abbreviations: CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment, SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# Online Examination, @$ Internal Online Examination, * 6week industrial training in summer break after 4th Semester

Course Category : Discipline Specific Course Core (DSC) : 2, Discipline Specific Elective (DSE) : 1, Value Education Course (VEC) : 1, Ability Enhancement Course (AEC) : 1, Skill Enhancement Course (SEC) : 2.

Curriculum Coordinator **Head Diploma in Mechanical Engineering** **Dean Diploma**

DIPLOMA PROGRAMME	**: DIPLOMA IN MECHANICAL ENGINEERING**
PROGRAMME CODE	**: DME**
SEMESTER	**: SIXTH**
COURSE TITLE	**: MACHINE DESIGN**
COURSE CODE	**: 234ME61**

I. TEACHING AND EXAMINATION SCHEME

TEACHING SCHEME					EXAMINATION SCHEME											
						Theory					Based on LL & TL				Based on Self-learning		TOTAL MARKS
											Practical						
CL	TL	LL	Self-learning	CR	PAPER HRS	FA-TH (MST)	SA-TH (ESE)		TOTAL		FA-PR (CA)		SA-PR (PR/OR)		SLA		
						Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
4	-	2	2	3	3	30	70	28	100	40	25	10	25#	10	25	10	175

II. RATIONALE

The Diploma Engineers in practical field come cross the situations involving design & drafting of machine components & assembles incorporating various aspect of design such as strength, rigidity, functional design, Ergonomics considerations, Economy etc. In view of this he/she has to select appropriate materials & heat treatment for manufacturing the machine parts. Considering this it is very important to expose the diploma engineers to fundamental concept machine design. Machine parts fail due to different causes & different types of loads. Many of parts are subjected to combined loading and hence requires analysis of the stress induced. The selection of materials for particular applications is also essential. The shapes of the parts and manufacturing processes are also to be considered. Hence considerations of the all points is essential before the final shapes & sizes of the part is decided.

III. COURSE OUTCOMES (COS)

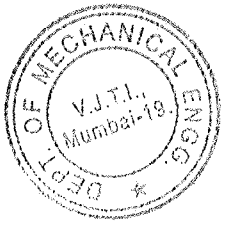
Students will be able to achieve the following CO's on completion of course are,

CO1: To estimate allowable loads in machine elements like simple machine elements and various types of levers using failure theories. (Draw results)
CO2: To understand steady and variable stresses induced in machine elements for different applications like helical and leaf springs, power screw, etc.
CO3: To analyze shaft, keys, keyway, couplings and types of bearings for specific applications.

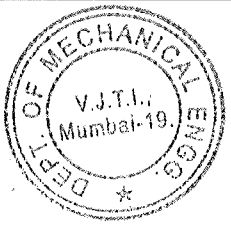
Design friction drives for specific applications. (Draw results)
CO4: To understand the various types of joints like cotter, knuckle, welded & bolted.

IV. COURSE CONTENTS WITH SPECIFICATION TABLE

SECTION - I							
Unit & Sub-Unit	Topics/Sub-topics	**COs**	**Hours**	R Level	U Level	A Level	**Total Marks**
Unit – I	**Simple Machine Elements**	CO1	06	-	3	3	06
1.1	Forces resulting in combined direct and bending stresses						
1.2	Design of clamp frame						
1.3	Design of offset links						
1.4	Design of bracket cross sections.						
1.5	Design of Column.						
1.6	Design of Simple link mechanism.						
Unit - II	**Design of Levers**	CO1	06	2	3	4	09
2.1	Forces resulting in bending stresses:						
2.2	Design of lever safety valve						
2.3	Design of bell crank lever						
2.4	Design of rocker arms						
2.5	Design of hand operated lever.						
2.6	Design of foot operated lever.						
2.7	Design of bearing caps.						
Unit - III	**Design of Springs**	CO2	08	2	3	3	08
3.1	Springs Design Procedure: Design of closed coil springs.						
3.2	Wahl's stress concentration factor.						
3.3	Applications such as I.C. engine valves, boiler safety valves.						
3.4	Railway buffers, weighing balance.						
3.5	Springs in series and parallel.						
Unit - IV	**Design of Power Screw**	CO2	12	2	3	3	08
4.1	Design of power screws: Different types of thread profiles used in power screws.						
4.2	Design of power screws with the consideration of maximum principle and shear stress theory, buckling, efficiency and self-locking conditions.						
4.3	Design of bolted type screw jacks, toggle jack, screw clamp, sluice valve, design of turn buckle.						



SECTION - II							
Unit & Sub-Unit	Topics/Sub-topics	**COs**	**Hours**	R Level	U Level	A Level	**Total Marks**
Unit - V	**Design of Shafts, keys, Keyways**	CO3	06	2	3	4	09
5.1	Forces resulting into torsion, combined bending and torsion:						
5.2	Design of shafts on the basis of strength and torsional rigidity						
5.3	Solid and hollow shafts.						
5.4	Numerical on Type A – Gear + Pulley Type B – Pulley + Pulley Type C – Gear + Gear						
Unit - VI	**Design of Couplings**	CO3	04	2	2	4	08
6.1	Design of muff & Split couplings						
6.2	Rigid flange couplings						
6.3	Flexible couplings						
Unit - VII	**Design of Bearings**	CO3	08	2	3	3	08
7.1	Types of bearings, sliding and rolling contact bearings and comparison						
7.2	Selection of bearings from handbooks						
7.3	Causes of bearing failures, mounting of bearings.						
Unit – VIII Joints	**Design of Cotter and Knuckle**	CO4	06	2	2	4	08
8.1	Forces resulting in direct tension compression and shearing.						
8.2	Design of cotter joint and their types.						
8.3	Design of knuckle joint and their types.						
Unit – IX	**Design of Welded and Bolted Joints**	CO4	08	-	2	4	06
9.1	Design of welded joints: Joints subjected to axial loading and eccentric loading.						
9.2	Design of bolted connections: Stress in screw fastening, bolt of uniform strength						
9.3	Design of bolted joints arranged symmetrically and subject to eccentric loading.						
Grand Total			**64**	**14**	**24**	**32**	**70**



V. LIST OF PRACTICALS/ASSIGNBMENTS/TUTORIALS

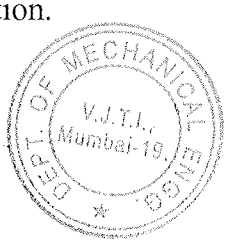
Sr. No.	**Assignments on following topics**	Approx. Hours	CO
1	Design of C Frame	3	1
2	Design of Column		1
3	Design of Bolted Joints	3	4
4	Design of Welded Joints		4
5	Design of Shafts	3	3
6	Design of Screw Jack		2
7	Design of Springs	3	2
8	Design of Bearing		3
Sr. No.	**Graphical work on following topics**	Approx. Hours	
8*	Design of Cotter Joint	4	4
9*	Design of Knuckle Joint	4	4
10*	Design of Hand / Foot Levers	4	1
11*	Design of Safety valve : Weight / Spring operated	4	1
12*	Design of Rigid / Flexible Coupling.	4	3

- **Note:** Out of above suggestive '*' marked practicals are mandatory.

VI. SUGGESTED SELF LEARNING ASSIGNMENTS/MICROPROJECT/ACTIVITIES

Micro project

- Write all the formulas & equations required to solve machine design problems.
- Take any day to day life component, find load, stresses and also prepare chart/ model for the same.
- Make models of various joints and levers highlights resisting sections of different elements.
- Make a chart indicating different thread profile and sizes required for different loads in case of screw jack, toggle jack, C-clamps and lead screw of machines.
- Prepare model of eccentrically loaded bolted and welded joint and high lights the maximum loaded section.
- Prepare list of different types of bearings used in in a bike and write their specifications and basis for selection.
- Prepare list of different types of Gears used in Agriculture machinery, Sugar can juice machine, gear boxes of two & three wheelers and similar machines and write their specifications and basis for selection.



- Prepare list of different types of levers and springs used in a bike, bicycle, Auto Rickshaw, Moped and write their specifications and basis for selection.

Note:

- If a micro project is assigned, it is expected to be completed as a group activity. SLA marks shall be awarded as per the continuous assessment record.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VII. ASSESMENTS METHODOLOGIES /TOOLS

Formative assessment (Assessment for Learning)

- One midterm test of 30 marks will be conducted and test marks will be considered.
- For formative assessment of laboratory learning 25 marks.
- Each practical will be assessed considering appropriate % weightage to process and product and other instructions of assessment.

Summative Assessment (Assessment of Learning)

- Pen and Paper Test (Written Test)

VIII. SUGGESTED COS-POS AND COS-PSOS MATRIX FORM

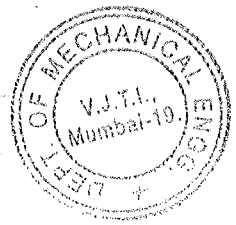
Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	3	2	2	1	--	2	1	--	--
CO2	3	3	3	3	1	--	3	-	--	--
CO3	3	3	2	1	1	--	2	-	--	--
CO4	3	3	2	1	1	--	2	1	--	--

Legends: - High: 03, Medium: 02, Low: 01, No Mapping: --

IX. SUGGESTED LEARNING MATERIALS TEXTBOOKS/REFRENCE BOOKS/WEBSITES

Sr.No	Author	Title	Publisher with ISBN Number
1	Khurmi R.S., Gupta J.K.	Machine Design	S. Chand and Co. Ltd. New Delhi, 2005, ISBN 10:8121925371
2	Bhandari V. B.	Design of Machine Elements	McGraw Hill Education; New Delhi 2017, ISBN-13: 978-9339221126

Curriculum Coordinator Head of the Department Dean Diploma



DIPLOMA PROGRAMME	**: DIPLOMA IN MECHANICAL ENGINEERING**
PROGRAMME CODE	**: DME**
SEMESTER	**: SIXTH**
COURSE TITLE	**: REFRIGERATION AND AIR CONDITIONING**
COURSE CODE	**: 234ME62**

I. TEACHING AND EXAMINATION SCHEME

TEACHING SCHEME					EXAMINATION SCHEME												
CL	TL	LL	Self-learning	CR	PAPER HRS	FA-TH (MST)	SA-TH (ESE)		TOTAL		Based on LL & TL Practical				Based on Self-learning		TOTAL MARKS
											FA-PR (CA)		SA-PR (PR/OR)		SLA		
						Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
4	-	2	2	4	3	30	70	28	100	40	25	10	25#	10	25	10	175

II. RATIONALE

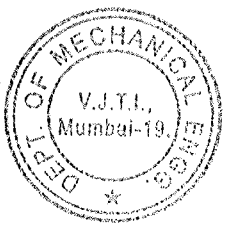
Diploma programs are designed to equip students with the skills and knowledge needed to be work-ready from the outset. The Indian HVAC&R industry is among the largest globally, indicating a significant need for qualified professionals. With increasing awareness of climate change and energy efficiency, RAC systems play a crucial role in sustainable practices.

RAC diploma holders can contribute to developing and implementing energy-efficient cooling solutions. The goal is to provide students with the necessary skills and competencies for gainful employment in the RAC field.

III. COURSE OUTCOMES (COS)

Student should be able to

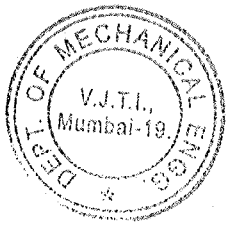
CO1	Understand the fundamental principles of theory, operation and applications of refrigeration and air conditioning systems and its components.
CO2	Understand the cooling capacity of refrigeration systems and analyze air refrigeration systems.
CO3	Understand working of different refrigeration systems and it's maintenance and be able to analyze performance of vapour compression refrigeration systems using refrigeration tables, P-h diagrams and experimentation.



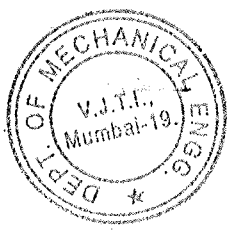
CO4	Learn and use concepts of psychrometry, psychrometric charts and apply the same in solving problems of psychrometry.
CO5	Able to understand and apply the concepts of psychrometric processes and simple cooling load calculations and component selection in air conditioning systems.

IV. COURSE CONTENTS WITH SPECIFICATION TABLE

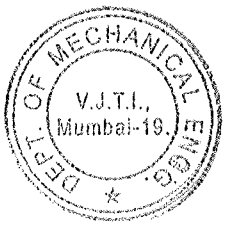
SECTION – I								
Unit & Sub-Unit		**Topics / Sub-topics**	**Hrs**	**Marks**	**CO**	**R Level**	**U Level**	**A Level**
1		**Refrigeration:**	2	3	CO 1,2	20	70	10
	1.1	Definition, Necessity of refrigeration, Heat Engine, Heat Pump and Refrigerator						
	1.2	Refrigeration effect, Ton of refrigeration, COP, EER & ISEER.						
	1.3	Refrigeration systems.						
2		**Vapour Compression Refrigeration Systems**	7	10	CO 1,3	20	30	50
	2.1	Vapour compression refrigeration cycle.						
	2.2	Application of I Law of Thermodynamics to the cycle and major components Viz. compressor, condenser, expansion device and evaporator.						
	2.3	Vapour compression Cycle on P-h and T–s diagrams.						
	2.4	Reversed Carnot Cycle for vapour as refrigerant.						
	2.5	Carnot COP for Refrigerator and Heat Pump.						
	2.6	Limitations of Reversed Carnot cycle.						



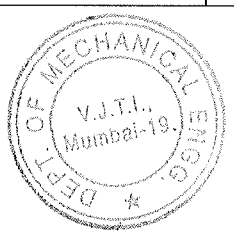
	2.7	Numerical problems on Vapour compression cycle, Use of refrigeration tables and charts for solving the problems.						
	2.8	Effects of Suction and Discharge pressures, Subcooling of the liquid refrigerant, Superheating of Vapour refrigerant on the COP of system. (No numerical Problems)						
3		**Refrigeration System Equipments** (No Numericals)	5	8	CO 1,3	10	30	60
	3.1	Compressors: Classification, Construction and working of different types of compressors Viz. open, hermetic, semi hermetic, reciprocating, rotary, Screw, Scroll, Centrifugal compressors used in refrigeration systems. Applications and comparisons. Capacity control of Compressors.						
	3.2	Condensers: Classification, Construction and working of Air cooled, Water cooled, Evaporative condensers. Applications and comparisons.						
	3.3	Expansion Devices: Capillary Tube, Hand operated valve, Automatic Expansion Valve, Thermostatic expansion valve, High side and low side floats. Applications and comparisons.						
	3.4	Evaporators and Chillers: Bare tube, Plate surface, Finned, Shell and tube, Flooded, Dry Expansion type Evaporators. Construction, applications and comparisons.						



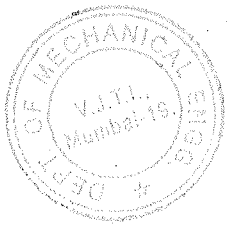
	3.5	Use of strainer dryer, receiver, accumulator, oil separator in refrigeration systems.						
	3.6	Controls used in refrigeration systems like Thermostat, HP and LP cutouts, Overload Protectors etc.						
	3.7	Variable Refrigeration Flow (VRF) systems, Variable Frequency Drive (VFD), Radiant cooling, Inverter Air Conditioners						
4		**Vapour Absorption Refrigeration Systems (No Numericals)**	2	4	CO 1,3	20	30	50
	4.1	Principle, components and working of aqua ammonia, lithium bromide-water and Electrolux systems.						
5		**Air Refrigeration Systems**	4	6	CO 1,2	20	30	50
	5.1	Reversed Carnot cycle, P-V and T-s diagram						
	5.2	Application of Air Refrigeration system						
	5.3	Necessity of refrigeration in air craft air conditioning						
	5.5	Bell Coleman air refrigeration cycle, P-V and T-s diagram, COP, Simple Numerical Problems.						
	5.4	Air refrigeration systems- Simple air cooling system, simple air evaporative cooling system, bootstrap air cooling system (No Numerical Problems) Air cycle Machines and Air conditioning Packs (pressurized air conditioning kits)						
	5.5	Comparison of Vapour compression, Vapour absoption and air refrigeration systems						



6		**Refrigerants**	2	4	CO 1	40	20	40
	6.1	Property requirements, Comparisons, Primary and Secondary refrigerants CFC, HCFC, HFC and HC as refrigerants, Inorganic refrigerants.						
	6.2	Refrigerant Nomenclature.						
	6.3	Ozone Depletion Potential (ODP) and Global Warming Potential (GWP), Eco friendly refrigerants.						
SECTION – II								
Unit & Sub-Unit		**Topics/Sub-topics**	**Hrs**	**Marks**	**CO**	**R Level**	**U Level**	**A Level**
7		**Air Conditioning:**	4	6	CO 1,4	30	50	20
	7.1	Psychrometry – DBT, WBT, DPT, humidity ratio, specific Humidity, relative Humidity, absolute Humidity.						
	7.2	Specific enthalpy and specific volume of moist air, Psychrometric chart comfort conditions. Bypass Factor, SHF (Simple numerical).						
8		**Psychrometric Processes:**	6	8	CO 1,4	20	50	30
	8.1	Simple process such as sensible heating and cooling, humidification, dehumidification and combinations.						
	8.2	Arrangements for heating, cooling, humidification and dehumidification etc.						
	8.3	Adiabatic Mixing of two air streams.						
	8.4	Simple numericals using psychrometric chart.						



9		**Cooling load calculations:**	4	6	CO 1,5	20	40	40
	9.1	Indoor and outdoor design conditions.						
	9.2	Comfort Conditions, Factors affecting human comfort, Effective temperature						
	9.3	Components of cooling Load.						
	9.4	Sensible and Latent Heat gain.						
	9.5	Room Sensible Heat Factor						
	9.6	Calculations of cooling load, Simple applications, Simple Numericals.						
10		**Air conditioning Systems and Equipments: (No Numericals)**	6	8	CO 1,5	10	40	50
	10.1	Summer, winter and year round air conditioning systems.						
	10.2	Central and unitary air conditioning systems.						
	10.3	Industrial and commercial air conditioning systems						
	10.4	Window A/C, Split A/C, Packaged A/C						
	10.5	Centralized Air conditioning systems						
	10.6	Dehumidifiers, humidifiers, heating and cooling coils.						
	10.7	Air washers.						
	10.8	Dessert Air coolers.						
	10.9	Chillers, AHU						
11		**Air and water distribution systems: (No Numericals)**	2	4	CO 1,5	10	40	50



	11.1	Duct systems, duct materials, duct losses						
	11.2	Fans and Blowers						
	11.3	Insulation, Acoustic and Thermal Insulation, Insulation Materials.						
	11.4	Cooling tower, cooling and chilled water piping.						
12		**Applications of Refrigeration and Air conditioning Systems:**	1	3	CO 5	10	40	50
	12.1	Domestic Applications.						
	12.2	Commercial Applications.						
	12.3	Industrial Applications.						
	12.4	Automobile Applications.						
Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxanomy).								

V. List of Practicals / Assignments / Tutorials :

(Minimum eight practicals should be conducted out of the followings.)

Sr. No.	Practical /Assignment	CO
1	Identification of refrigeration system components and their locations in applications like window A/c, domestic refrigerators, water cooler and Ice plant.	CO 1
2	Identification of different types of refrigeration compressors and its components.	CO 1
3	Visit to cold storage/central air conditioning/packaged unit installation.	CO 1
4	Trial on a/c tutor to study cooling and dehumidification process.	CO 4
5	Trial on a/c tutor to study sensible heating process.	CO 4
6	Trial on a/c tutor to study process of mixing of two air streams.	CO 4
7	Trial on refrigeration tutor to study vapour compression cycle.	CO 3

8	Trial on refrigeration tutor to study effect of condensing load on performance of vapour compression cycle.	CO 3
9	Identification of various controls in refrigeration and air conditioning.	CO 1
10	Trial on water cooler to study its performance by variation of cooling load.	CO 1
11	Cooling load estimation using Excel sheet for an application.	CO 5

VI. ASSESMENTS METHODOLOGIES /TOOLS

Formative Assessment (Assessment of Learning)

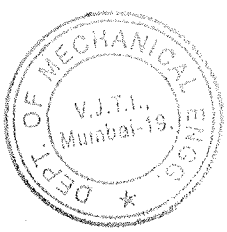
- Mid semester test
- Timely evaluation of Assignments
- Continuous evaluation of Sheets

Summative Assessment (Assessment of Learning)

- End Semester Exam
- Oral exam

VII. SUGGESTED COS-POS AND COS-PSOS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2
CO1	03	-	-	-	-	-	-	01	-
CO2	03	01	01	-	02	-	-	01	01
CO3	03	02	03	02	02	-	02	02	01
CO4	03	-	-	03	-	-	-	02	-
CO5	03	02	03	03	02	-	02	03	01
Legends :- High:03, Medium:02,Low:01, No Mapping: -									



VIII. SUGGESTED LEARNING MATERIALS TEXTBOOKS/REFRENCE BOOKS/WEBSITES

Text Books:

Sr. No.	Author	Title	Publisher and Edition
1	R.S. Khurmi, J.K. Gupta	A text book of Refrigeration & Air conditioning	S. Chand Publications, Fifth Edition
2	Ananthanarayanan	Basic Refrigeration & Air conditioning	Tata McGraw Hill, Fourth Edition

Reference books and Websites:

Sr. No.	Author	Title	Publisher and Edition
1	Domkundwar, Arora and Domkundwar	A course in Refrigeration & Air conditioning	Dhanpatrai & Co , Eighth Edition
2	C.P.Arora	Refrigeration and air conditioning	Tata Mc GrawHill, Third Edition
2	Roy J. Dossat	Principles of Refrigeration	Pearson Education-Fifth edition.
3	Manohar Prasad	Refrigeration & Air conditioning	New Age Publishers, Second Edition-2005.
4	Edward Pita.	Air conditioning principles and systems- an energy approach	Tata McGraw Hill, Fourth Edition
	Websites	https://onlinecourses.nptel.ac.in/noc24_me77/preview	

Curriculum Coordinator

Head of the Department

Dean Diploma

DIPLOMA PROGRAMME	**: DIPLOMA IN MECHANICAL ENGINEERING**
PROGRAMME CODE	**: DME**
SEMESTER	**: SIXTH**
COURSE TITLE	**: INDUSTRIAL MANAGEMENT**
COURSE CODE	**: 234ME63**

I. TEACHING AND EXAMINATION SCHEME

TEACHING SCHEME					EXAMINATION SCHEME												
CL	TL	LL	Self-learning	CR	PAPER HRS	FA-TH (MST)	SA-TH (ESE)		TOTAL		Based on LL & TL Practical				Based on Self-learning		TOTAL MARKS
											FA-PR (CA)		SA-PR (PR/OR)		SLA		
						Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
4	-	2	-	3	3	30	70	28	100	40	25	10	25#	10	-	-	150

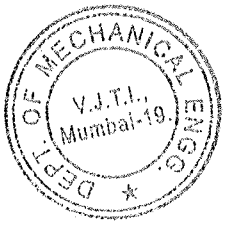
II. RATIONAL

This course introduces the basic concepts of Industrial Management which is concerned with the design, improvement and installation of integrated systems of men, materials, equipment and energy. The emphasis of this course is laid on the basic analysis of designing organizational structures, plant layouts, inspection and quality control, project management & fundamental management principles and practices. This course attempts to impart the necessary knowledge and develop the required abilities so that he can perform his job efficiently and effectively in modern industry.

III. COURSE OUTCOMES (COs)

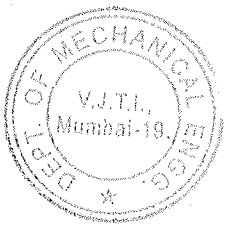
Students will be able to achieve the following COs on completion of course based learning

CO1	To understand importance of management and to relate the concepts of management with industrial organizations and manage organizations efficiently.
CO2	Have the basic knowledge of material management, plant management and make decisions proficiently.
CO3	Explain and analyse the importance of project management and financial management statements.
CO4	To understand the importance of quality & quality improvement techniques.



IV. COURSE CONTENTS WITH SPECIFICATION TABLE

SECTION – I								
Unit & Sub-Unit		**Topics / Sub-topics**	**Hrs**	**Marks**	**CO**	**R Level**	**U Level**	**A Level**
1		**Management Process**	08	09	1	20	40	40
	1.1	Various definitions, Concept of management, Levels of management, Administration & management, Scientific management by F.W.Taylor						
	1.2	Principles of Management (14 principles of Henry Fayol)						
	1.3	Functions of Management- Planning, Organizing, Directing, Controlling & Decision Making						
2		**Organizational Management**	08	08	1	20	40	40
	2.1	Organization: Definition, Steps in organization						
	2.2	Types of organization – Line, Line & staff, Functional and Project						
	2.3	Principles of Organisation • Authority & Responsibility • Span of Control • Effective Delegation						
3		**Materials Management**	08	09	2	20	40	40
	3.1	Inventory Concept, its classification, functions of inventory						
	3.2	Economic Order Quantity Concept, graphical representation, determination of EOQ						
	3.3	Modern Techniques of Material Management • Material Resource Planning (MRP) - Functions of MRP, Input to MRP, Benefits of MRP • Enterprise Resource Planning (ERP) - Concept, list of modules, advantages & disadvantages of ERP						



4		**Plant Management**	08	09	2	20	40	40
	4.1	Plant location, Factors affecting plant location:						
	4.2	Plant Layout, Type of plant layout,						
	4.3	Factors influencing plant layout, Principles of plant layout:						
	4.4	Productivity, Method of Production						

SECTION – II								
Unit & Sub-Unit		**Topics/Sub-topics**	**Hrs**	**Marks**	**CO**	**R Level**	**U Level**	**A Level**
5		**Project Management**	10	11	3	30	30	40
	5.1	Concepts of project planning, monitoring and control.						
	5.2	Project management through network analysis, CPM & PERT.						
6	**6.1**	**Financial Management**	10	11	3	20	40	40
		Objectives, Functions,						
	6.2	Financial Statements						
		Types of capitals, Sources of raising captals						
7		**Quality Management**	12	13	4	20	40	40
	7.1	Meaning of Quality Quality Control, Quality Circle, Quality Assurance						
		TQM - Concept, Elements of TQM, Benefits						
		Modern Technique & Systems of Quality Management like 5'S',Six Sigma, Kaizen						
		ISO 9001:2000 - Benefits, Main clauses.						

Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxanomy).

V. LIST OF PRACTICALS/ASSIGNBMENTS/TUTORIALS

Sr. No.	Unit	Practical /Assignment	CO
1	1	Assignment on management, level of management, functions of management and administration.	1
2	2	Assignment of organization, types and structure of organization.	1
3	3	Assignment on material management.	1
4	4	Assignment on plant management	3
5	5	Assignment on project management	2
6	6	Assignment on financial management	2
7	5	Assignment on quality management	2

VI. SUGGESTED SELF LEARNING ASSIGNMENTS/MICROPROJECT/ACTIVITIES

a. Prepare wall chart of 3 Sigma and Six Sigma curves and compare number of defectives/rejection in parts per millions (PPM)
b. Prepare list of National/International industries working on principle of Six Sigma technique.
c. Visit any production industry. Collect the actual data from production and quality control department. Calculate mean, mode and median for the collected data.

Project:

a. Visit any manufacturing industry. Observe the working of type of inspection practices carried out and prepare a report. Also analyse actual quality control practices.

VII. ASSESMENTS METHODOLOGIES /TOOLS

Formative Assessment (Assessment of Learning)

- Mid semester test
- Timely practical journal completion
- Performance in practicals

Summative Assessment (Assessment of Learning)

- End Term Exam
- Practical exam

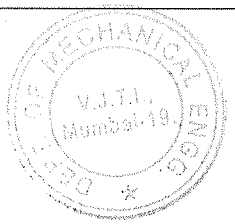
VIII. SUGGESTED COS-POS AND COS-PSOS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)								
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO- 1	PSO- 2
CO1	3	3	1	1	2	2	3	3	2
CO2	3	3	1	2	2	2	1	2	1
CO3	3	2	2	3	2	3	2	3	2
CO4	2	1	2	3	3	2	2	2	1

IX. SUGGESTED LEARNING MATERIALS TEXTBOOKS/REFRENCE BOOKS /WEBSITES

Text Books:

Sr. No.	Author	Title	Publisher and Edition
1	Dr. O.P. Khanna	Industrial Engineering & Management	Dhanpat Rai & Sons New Delhi
2	Martand Telsang	Industrial Engineering & Management	S. Chand & Company Ltd., New Delhi
3	Robert Liby, Patricia A. Libby, Daniel G. Short	Financial Accounting	McGraw Hill Irwin, Seventh Edition

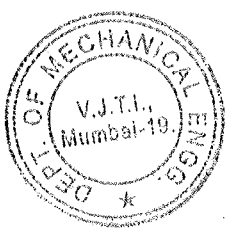


4	Jay Heizer, Barry Render,	Operation Management	Person Publication, 3rd Edition, 2011.

Reference books and Websites:

Sr. No.	Author	Title	Publisher and Edition
1	Banga & Sharma	Industrial Engineering & Management	Khanna Publication
2	Dr. S.C. Saksena	Business Administration & Management	Sahitya Bhavan Agra
3	Ebert, J and Adams, D.J.	Production/Operations Management	Prentice Hall of India, New Delhi, 2007
4	Premkumar Gupta and Hira	Operation Research	S. Chand Company Ltd., New Delhi, 2007

Curriculum Coordinator Head of the Department Dean Diploma



DIPLOMA PROGRAMME	**: DIPLOMA IN MECHANICAL ENGINEERING**
PROGRAMME CODE	**: DME**
SEMESTER	**: SIXTH**
COURSE TITLE	**: ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS**
COURSE CODE	**: 234ME65**

I. TEACHING AND EXAMINATION SCHEME

TEACHING SCHEME					EXAMINATION SCHEME												
CL	TL	LL	Self-learning	CR	PAPER HRS	FA-TH (MST)		SA-TH (ESE)		TOTAL		Based on LL & TL Practical				Based on Self-learning		TOTAL MARKS
												FA-PR (CA)		SA-PR (PR/OR)		SLA		
						Max		Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
1	1	2	-	2	-	-		-	-	-	-	25	10	25#	10	-	-	50

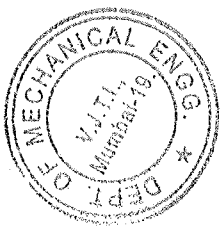
II. RATIONALE

Entrepreneurship is essential for innovation, job creation, and economic development. This subject introduces diploma students to the fundamentals of starting and managing a business, helping them develop an entrepreneurial mindset and practical skills.

The course covers business planning, financial management, marketing, and legal aspects, with a focus on real-world applications. It encourages creativity, problem-solving, and decision-making, preparing students to explore self-employment or contribute to existing businesses.

Aligned with national initiatives like Startup India and various incubation programs, the course familiarizes students with modern entrepreneurial trends such as technology-driven businesses and sustainable startups.

By the end of the course, diploma students will have the confidence and skills to identify opportunities, develop business ideas, and take the first steps toward entrepreneurship or business leadership in a dynamic economy.



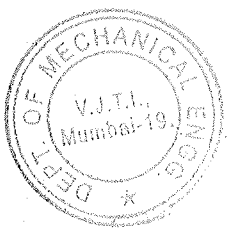
III. COURSE OUTCOMES (COS)

Students will be able to achieve the following COS on completion of course based learning

- CO1 - Understand entrepreneurship fundamentals and its role in economic growth.
- CO2 - Identify and evaluate business opportunities relevant to mechanical engineering.
- CO3 -Develop and manage business plans, financial strategies, and marketing techniques.
- CO4 -Apply legal, operational, and quality management aspects in a startup environment also explore emerging trends, sustainability, and innovation in entrepreneurship.

IV. COURSE CONTENTS WITH SPECIFICATION TABLE

SECTION - I							
Unit & Sub-Unit	Topics/Sub-topics	Hours	Marks	COS	R Level	U Level	A Level
1	**Introduction to Entrepreneurship**	3	-	1	40%	35%	25%
1.1	Definition, characteristics, and significance of entrepreneurship						
1.2	Entrepreneur vs. Intrapreneur						
1.3	Types of entrepreneurs and business models						
1.4	Role of entrepreneurship in economic development.						
2	**Business Opportunities and Idea Generation**	3	-	2	30%	40%	30%
2.1	Identifying and evaluating business opportunities						
2.2	Market research and feasibility analysis						
2.3	Innovation and creativity in entrepreneurship						
3	**Business Planning and Financial Management**	2	-	3	40%	35%	25%
3.1	Components of a business plan						
3.2	Basics of financial planning: funding sources, budgeting, and cost estimation						
3.3	Profit and loss analysis, break-even analysis						
3.4	Government funding schemes and financial assistance for startups						



SECTION - II							
Unit & Sub-Unit	Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
4	**Marketing and Business Operations**	3	-	3	30%	35%	35%
4.1	Marketing strategies for startups						
4.2	Branding, pricing, and promotion techniques						
4.3	Supply chain management and operational planning						
4.4	Quality management and customer satisfaction						
5	**Legal Aspects and Government Support**	2	-	4	40%	35%	25%
5.1	Business registration and legal formalities						
5.2	Intellectual property rights (IPR) – patents, trademarks, copyrights						
5.3	Startup India, Make in India, and incubation centers						
5.4	Industrial laws and compliance for small businesses						
6	**Emerging Trends and Sustainability in Entrepreneurship**	3	-	4	30%	35%	35%
6.1	Technology-driven businesses and digital entrepreneurship						
6.2	Sustainable and eco-friendly business models						
6.3	Challenges and risks in entrepreneurship						

V. LIST OF PRACTICALS/ASSIGNBMENTS/TUTORIALS

Sr. No.	Practical/Assignment/Tutorial Title	No. of Hours	Relevant COS
1	Understanding Entrepreneurial Characteristics – Case study discussion on entrepreneurial traits.	2	1
2	Market Feasibility Analysis – Step-by-step tutorial on conducting market research.	2	2
3	Business Plan Components – Detailed breakdown of business plan structure with examples.	2	2
4	Financial Management Basics – Hands-on tutorial on budget planning and cost estimation	2	3

5	Startup Marketing Strategies – Report on branding, pricing, and promotional methods.	2	3
6	Legal and Compliance for Startups – Interactive session on business registration and IPR basics.	2	4
7	Digital and Tech-driven Entrepreneurship – Exploring digital business models and e-commerce trends.	2	4
8	Sustainability in Business – Analysis of green startups and eco-friendly business practices.	2	4

VI. SUGGESTED SELF LEARNING ASSIGNMENTS/MICROPROJECT/ACTIVITIES

Assignments

- Characteristics of Entrepreneurs – Write a report on famous entrepreneurs and their journey.
- Identifying Business Opportunities – Select an industry and identify at least three business opportunities.
- Comparison of Business Models – Compare two different business models (B2B vs. B2C, franchise vs. startup, etc.).

Micro Project

- Case studies of innovative mechanical engineering startups
- Business Idea Development & Feasibility Analysis

VII. ASSESMENTS METHODOLOGIES /TOOLS

Formative Assessment (Assessment of Learning)

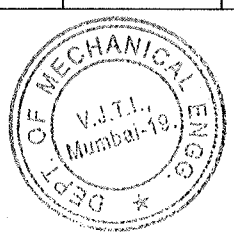
- Timely practical journal completion
- Performance in practicals

Summative Assessment (Assessment of Learning)

- Oral exam

VIII. SUGGESTED COS-POS AND COS-PSOS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO- 1	PSO- 2



CO1	2	2	2	-	-	3	2	2	-
CO2	2	2	2	2	-	3	2	2	-
CO3	2	2	2	2	-	3	2	1	-
CO4	2	2	2	2	-	3	2	2	-
Legends :- High:03, Medium:02,Low:01, No Mapping: -									

IX. SUGGESTED LEARNING MATERIALS TEXTBOOKS/REFRENCE BOOKS/WEBSITES

Sr. No	Author	Title	Publisher
1	Trehan	Entrepreneurship	Dream Tech Press
2	Charantimath, Poornima	Entrepreneurship Development Small Business	Pearson Education India, New Delhi; ISBN: 9788131762264
3	Khanka, S.S.	Entrepreneurship and Small BusinessManagement	S.Chand and Sons, New Delhi, ISBN:978-93-5161-094-6
4	Dr. Nishith Dubey, AdityaVyas , Annu Soman , AnupamSingh	Un- boxing Entrepreneurship your selfhelp guide to setup a successfulbusiness	Indira Publishing House ISBN-2023,978-93-93577-70-2
5	Gujral, Raman	Reading Material of EntrepreneurshipAwareness Camp	Entrepreneurship DevelopmentInstitute of India (EDI), GOI, 2016Ahmedabad

Curriculum Coordinator Head of the Department Dean Diploma

DEPT. OF MECHANICAL ENGG. V.J.T.I., Mumbai-19.

DIPLOMA PROGRAMME	**: DIPLOMA IN MECHANICAL ENGINEERING**
PROGRAMME CODE	**: DME**
SEMESTER	**: SIXTH**
COURSE TITLE	**: COMPUTER PROGRAMMING (PYTHON)**
COURSE CODE	**: 234ME56**

I. TEACHING AND EXAMINATION SCHEME

TEACHING SCHEME					EXAMINATION SCHEME												
CL	TL	LL	Self-learning	CR	PAPER HRS	FA-TH (MST)	SA-TH (ESE)		TOTAL		Based on LL & TL Practical				Based on Self-learning		TOTAL MARKS
											FA-PR (CA)		SA-PR (PR/OR)		SLA		
						Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
1	-	2	-	1.5	-	-	-	-	-	-	25	10	25#	10	-	-	50

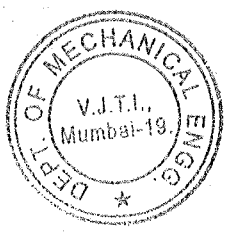
II. RATIONALE

Comprehension of programming languages is crucial for diploma engineering graduates, especially as they engage with various software applications in the mechanical engineering domain. Python, being easy to code, potent, and stands out as an ideal language for introducing computing and problem-solving concepts to beginners. This course enables students to write Python programs and utilize various built-in functions/methods of Python modules/libraries to solve specific problems.

III. COURSE OUTCOMES (COS)

Students will be able to achieve the following COS on completion of course based learning

- CO1 - Use program designing tools and IDE for python.
- CO2 - Employ python building blocks and data types in the programming.
- CO3 - Implement conditional and looping statements in the python programming.
- CO4 - Implement bult in functions and modules in the python programming.
- CO5 - Use NumPy for performing operations on list and array



IV. COURSE CONTENTS WITH SPECIFICATION TABLE

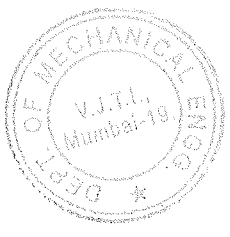
SECTION - I							
Unit & Sub-Unit	Topics/Sub-topics	Hours	Marks	COS	R Level	U Level	A Level
1	Introduction to Python Programming	3	5	1	40%	40%	20%
1.1	Revision of Computer Components (CPU, I/O devices)						
1.2	Applications of computer and programming languages in Mechanical engineering domain.						
1.3	Program Designing Tools: Algorithm, Flow Chart.						
1.4	Introduction and Features of Python: Open source, Interactive, Interpreted, Object-oriented, Platform independent etc., Installation & working of IDEs.						
2	Python building blocks & data types	4	5	2	40%	40%	20%
2.1	Python building blocks: Identifiers, Indentation, Comments, Variables, Arithmetic and assignment operators and Expressions.						
2.2	Data Types: Integers, float, complex, string and their declaration, data type conversion.						
2.3	Accepting input from user: I/O functions						
2.4	Container Types: List, tuple, set and their declaration.						
2.5	Write simple python program to display "Welcome" message.						

SECTION - II							
Unit & Sub-Unit	Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
3	Python operators and Control flow	3	5	3	40%	40%	20%
3.1	Relational and Logical operators						
3.2	Decision making statements: if,						

	if- else statements.						
3.3	Looping statements: while loop, for loop, Nested loops.						
3.4	Loop manipulation using continue, pass, break statements						
4	Python functions and modules	3	5	4	40%	40%	20%
4.1	Functions: Use of built-in functions, data conversion functions, abs, pow, min, max, round, ceil, floor etc.						
4.2	Modules: Use of built-in modules- math cmath, random and statistics.						
4.3	User-defined function: Function definition, function calling, function arguments and parameter passing, Return statement, scope of variables.						
5	List and arrays in python	3	5	5	40%	40%	20%
5.1	List: define list (one and multi-dimension), accessing, deleting and updating values in list.						
5.2	Basic list operations: slicing, repeating, concatenation and iteration.						
5.3	NumPy array: Generate NumPy arrays and construct multi-dimensional arrays.						

V. LIST OF PRACTICALS/ASSIGNBMENTS/TUTORIALS

Sr. No.	Practical/Assignment/Tutorial Title	No. of Hours	Relevant COS
1	Install Python IDE.	2	1
2	Prepare a flow chart and algorithm for simple problem	2	1
3	Write a simple program to display a simple message. (Ex: "Welcome to Python programming")	2	2
4	Write a simple Python program by taking user's input to -- find the area of rectangle- find the area or circle	2	2
5	Write a program to accept value of Celsius and convert it to Fahrenheit.	2	2
6	Write a python program to find whether the given number is even or odd using if - else statement.	2	3



7	Write a python program to check whether an input number is positive, negative or zero using if – else statement.	2	3
8	Write a program to accept the three sides of a triangle to check whether the triangle is isosceles, equilateral, right angled triangle.	2	3
9	Write a program that allows the user to input numbers until they choose to stop, and then displays the count of positive, negative, and zero numbers entered (Use while loop).	2	3
10	Write a python program for printing multiplication table of a given number using for loop.	2	3
11	Write a Python program to demonstrate the use of different mathematical functions (Ex. ceiling, floor etc).	2	4
12	Write a python program to find mean, mode, median and standard deviation using statistics module.	2	4
13	Write a python program utilizing a list to display the name of a month based on a given month number.	2	5
14	Write a python program to add or subtract two matrices using multidimensional list.	2	5
15	Write a python program to multiply two matrices using multidimensional list.	2	5
16	Write a python program to multiply two matrices using NumPy.	2	5

VI. SUGGESTED SELF LEARNING ASSIGNMENTS/MICROPROJECT/ACTIVITIES

Micro Project (if any)

Not Applicable

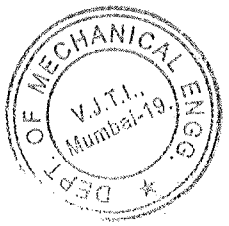
VII. ASSESMENTS METHODOLOGIES /TOOLS

Formative Assessment (Assessment of Learning)

- Timely practical journal completion
- Performance in practical's

Summative Assessment (Assessment of Learning)

- End Term Oral Exam
- Practical exam



VIII. SUGGESTED COS-POS AND COS-PSOS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)	
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO- 1	PSO- 2
CO1	2	2	2	3	-	-	2	2	-
CO2	2	2	2	3	-	-	2	2	-
CO3	2	2	2	3	-	-	2	1	-
CO4	2	2	2	3	-	-	2	2	-
CO5	2	2	2	3	-	-	2	1	-
Legends: - High:03, Medium:02, Low:01, No Mapping: -									

IX. SUGGESTED LEARNING MATERIALS TEXTBOOKS/REFRENCE BOOKS/WEBSITES

Sr. No	Author	Title	Publisher
1	Kenneth A. Lambert	Fundamentals of Python: First Programs, 2E	Cengage Learning India Private Limited, ISBN: 9789353502898
2	Yashavant Kanetkar, Aditya Kanetkar	Let Us Python - 6th Edition	BPB Publications, ISBN: 9789355515414

Curriculum Coordinator

Head of the Department

Dean Diploma

DEPT. OF MECHANICAL ENGG. V.J.T.I., Mumbai-19.

DIPLOMA PROGRAMME	**: DIPLOMA IN MECHANICAL ENGINEERING**
PROGRAMME CODE	**: DME**
SEMESTER	**: SIXTH**
COURSE TITLE	**: PROJECT II**
COURSE CODE	**: 234ME67**

I. TEACHING AND EXAMINATION SCHEME

TEACHING SCHEME					EXAMINATION SCHEME												
						Theory					Based on LL & TL				Based on Self-learning		
											Practical						
CL	TL	LL	Self-learning	CR	PAPER HRS	FA-TH (MST)	SA-TH (ESE)		TOTAL		FA-PR (CA)		SA-PR (PR/OR)		SLA		TOTAL MARKS
						Max	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	
-	-	6	-	3	-	-	-	-	-	-	100	25	100#	25	-	-	200

Course Objectives:

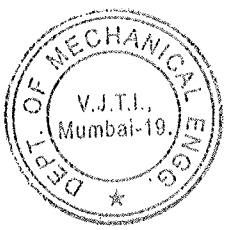
1. To apply the knowledge of basic engineering into practical application.
2. To work on the machines independently.
3. To learn to work in a team so that the students understand the work culture of an organisation.

Course Outcomes:

Student should be able to

- CO1 -- Work on machines with responsibility
- CO2 -- Application of theoretical knowledge into practical skills
- CO3 -- Should be able to generate ideas & express the same

INTRODUCTION: As the students will continue their project during this semester after completing certain amount of the work in the earlier semester



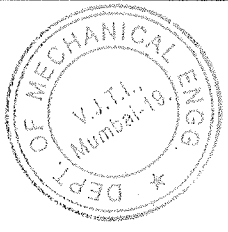
There are a wide range of project types such as service learning projects, work-based projects, task-oriented projects, problem-solving projects and so forth, but authentic projects all have in common these defining features:

Student centered, student directed, a definite beginning, middle, and end, content meaningful to students; directly observable in their environment, real-world problems, firsthand investigation, sensitivity to local culture and culturally appropriate, specific goals related to curriculum and institute, district, or state standards, a tangible product that can be shared with the intended audience, connections among academic, life, and work skills opportunity for feedback and assessments from expert sources, opportunity for reflective thinking and student self-assessment, authentic assessments (portfolios, journals, etc.)

Course Content:

Unit & Sub-Unit		Topics/Sub-topics	Hours	Marks	CO	R Level	U Level	A Level
1		Performance criteria				30	30	40
	1.1	Selection of project assignment	10	5	1			
	1.2	Planning and execution of considerations	10	10	2			
	1.3	Quality of performance	10	5	1			
	1.4	Providing solution of the problems or production of final product	10	10	3			
2		Sense of responsibility	5	5	1			
	2.1	Self expression communication skills coil Interpersonal skills/human relations/viva voce	5	10	2			
	2.2	Report writing skills.	10	5	3			

Legends: R- Remember, U – Understand, A – Apply and above levels (Blooms's Revised Taxanomy).



Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

Important Notes: This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.. The criteria for evaluation of the students have been worked out for 100 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination

The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the students performance as per the above criteria. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards. The teachers are free to evolve another criteria of assessment, depending upon the type of project work. It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial/field organization in such an exhibition. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific industries are approached for instituting such awards

Curriculum Coordinator | Head of the Department | Dean Diploma