MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES

COURSE NAME : DIPLOMA IN PRODUCTION ENGINEERING / PRODUCTION TECHNOLOGY

COURSE CODE : PG / PT

DURATION OF COURSE : 6 SEMESTERS **WITH EFFECT FROM 2012-13**

SEMESTER : SIXTH **DURATION : 16 WEEKS**

PATTERN : FULL TIME - SEMESTER **SCHEME : G**

SR. NO	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME									SW (17600)
							PAPER HRS.	TH (1)		PR (4)		OR (8)		TW (9)		
				TH	TU	PR		Max	Min	Max	Min	Max	Min	Max	Min	
1	Management $	MAN	17601	03	--	--	1&½	50#*	20	--	--	--	--	--	--	
2	Industrial Fluid Power	IFP	17608	04	--	02	03	100	40	--	--	25#	10	25@	10	
3	Production Engineering & Robotics β	PER	17609	04	--	--	03	100	40	--	--	--	--	--	--	
4	Automobile Engineering and Manufacturing	AEM	17614	04	--	02	03	100	40	--	--	--	--	25@	10	**50**
5	Tool Design	TDE	17615	03	--	02	03	100	40	--	--	25#	10	25@	10	
6	Solid Modelling	SMO	17063	01	--	02	--	--	--	25#	10	--	--	25@	10	
7	Project β	PRO	17090	--	--	04	--	--	--	--	--	50#	20	50@	20	
8	Entrepreneurship Development β	EDE	17099	01	01	--	--	--	--	--	--	--	--	25@	10	
			TOTAL	**20**	**01**	**12**	**--**	**450**	**--**	**25**	**--**	**100**	**--**	**175**	**--**	**50**

Student Contact Hours Per Week: **33 Hrs.**

THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.

Total Marks **: 800**

@ - Internal Assessment, # - External Assessment, [ ] No Theory Examination, $ - Common to all branches, #* - Online Examination,
β - Common to AE, ME, MH, MI, FE, FG

Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work

- Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 50 marks as sessional work (SW).
- Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.
- Code number for TH, PR, OR, TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.

Course Name : All Branches of Diploma in Engineering / Technology

Course Code : EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/CO/CM/IF/ CW/EE/EP/EU/CH/CT/PS/CD/ED/EI/CV/FE/IU/MH/MI/TX/TC/FG

Semester : Sixth for EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/ CO/CM/IF/CW/EE/EP/EU/CH/CT/PS/TX/TC/FG and Seventh for MH/MI/CD/ED/EI/ CV/FE/IU

Subject Title : Management

Subject Code : 17601

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	--	1&½	50#*	--	--	--	50

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

Management concepts are universal and it is a multidisciplinary subject. They are equally applicable to different types industries like Manufacturing, Service and Trade as well as different kind of business activities like industry, army, school, hospital, retail shops etc. Also, at the end of diploma course polytechnic students are expected to enter in to the Industrial Environment. This environment is altogether different and new to the students. A proper introduction and understanding of management fundamentals is therefore essential for all these students.

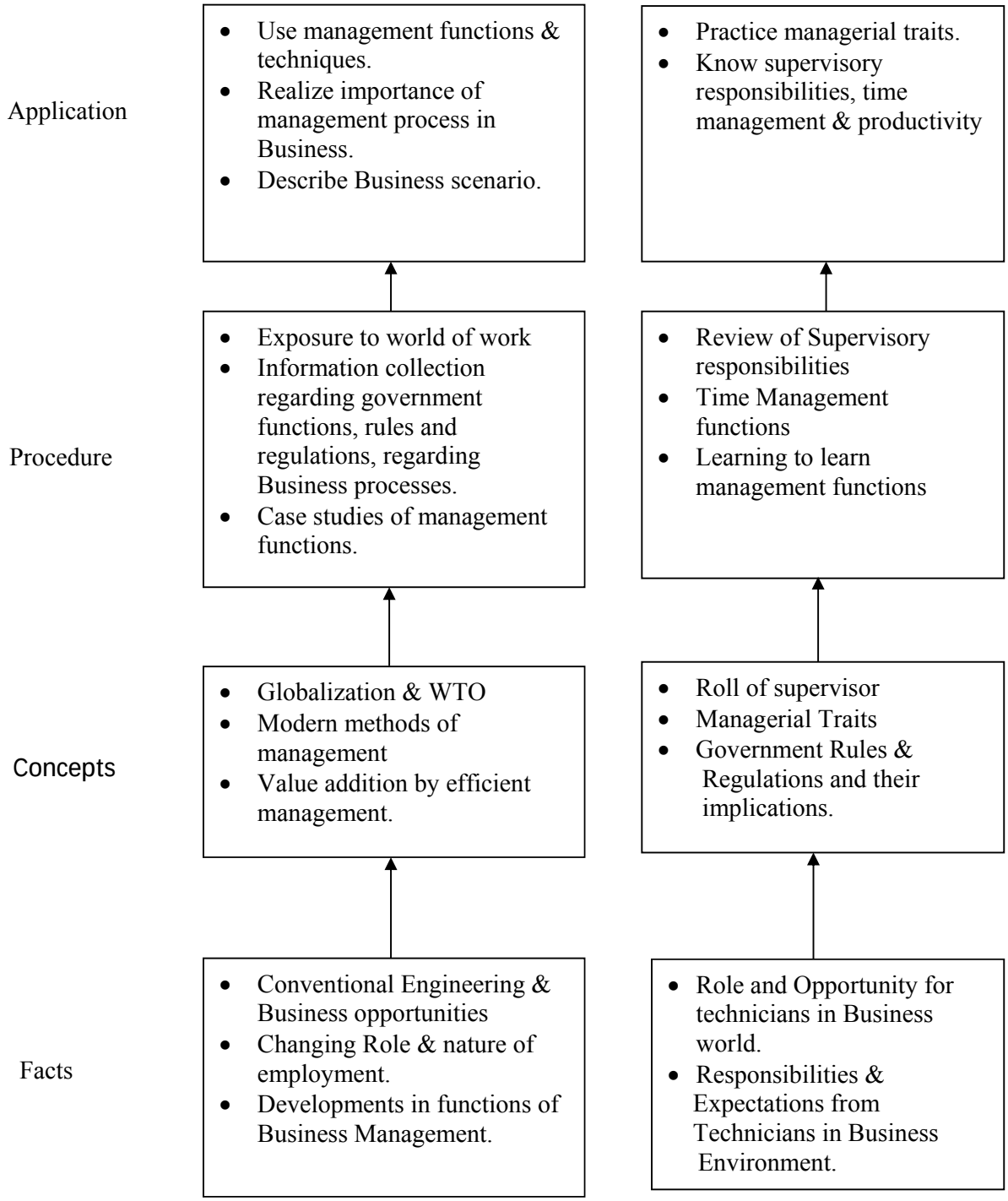
Contents of the this subject will enable the students to address various issues related to human resource, finance, materials, legislations etc. by use of basic principles of management. This will ensure that students will play their role effectively to enhance the quality of business output in total.

Objective:

The students will able to:

1. Get familiarized with environment related to business processes.
2. Know the management aspects of the organisations.
3. Understand Role & Responsibilities of a Diploma engineer.
4. Understand importance of quality improvement techniques.
5. Appreciate need and importance of safety in industries.
6. Understand process of Industrial finance and its management.
7. Know the latest trends in industrial management.

Learning Structure:



Contents: Theory

Topic and Contents	Hours	Marks
Topic 1: Overview of Business **Specific Objectives** ➢ State various business types and sectors ➢ Describe importance of globalisation 1.1. Types of Business • Service • Manufacturing • Trade 1.2. Industrial sectors Introduction to • Engineering industry • Process industry • Textile industry • Chemical industry • Agro industry • IT industry • Banking, Insurance, Retail, Hospitality, Health Care 1.3 Globalization • Introduction • Advantages & disadvantages with respect to India	02	04
Topic 2: Management Process **Specific Objectives** ➢ State various management principles ➢ Describe different management functions 2.1 What is Management? • Evolution • Various definitions of management • Concept of management • Levels of management • Administration & management • Scientific management by F.W.Taylor 2.2 Principles of Management (14 principles of Henry Fayol) 2.3 Functions of Management • Planning • Organizing • Directing • Controlling • Decision Making	08	08
Topic 3: Organisational Management **Specific Objectives** ➢ Compare different forms of organisation , ownership for a specific business ➢ Describe types of departmentation 3.1 Organization: • Definition	08	08

• Steps in organization 3.2 Types of organization • Line • Line & staff • Functional • Project 3.3 Departmentation • By product • By process • By function 3.4 Principles of Organisation • Authority & Responsibility • Span of Control • Effective Delegation • Balance, stability and flexibility • Communication 3.5 Forms of ownership • Proprietorship • Partnership • Joint stock • Co-operative Society • Govt. Sector		
Topic 4: Industrial Safety and Legislative Acts **Specific Objectives** ➢ Describe types of accidents & safety measures ➢ State provisions of industrial acts. 4.1 Safety Management • Causes of accidents • Types of Industrial Accidents • Preventive measures • Safety procedures 4.2 Industrial Legislation - Necessity of Acts Important Definitions & Main Provisions of following acts: • Indian Factory Act • Workman Compensation Act • Minimum Wages Act	08	06
Topic 5: Financial Management (No Numerical) **Specific Objectives** ➢ Explain functions of financial management ➢ State the sources of finance & types of budgets. ➢ Describe concepts of direct & indirect taxes. 5.1 Financial Management- Objectives & Functions 5.2 Capital Generation & Management • Types of Capitals - Fixed & Working • Sources of raising Capital - Features of Short term, Medium Term & Long Term Sources	08	08

5.3 Budgets and accounts • Types of Budgets • Fixed & Variable Budget - Concept • Production Budget - Sample format • Labour Budget - Sample format • Profit & Loss Account & Balance Sheet - Meaning, sample format, meaning of different terms involved. 5.4 Meaning & Examples of - • Excise Tax • Service Tax • Income Tax • Value Added Tax • Custom Duty		
Topic 6: Materials Management (No Numerical) **Specific Objectives** ➢ Describe concept of inventory, ABC analysis & EOQ. ➢ Describe purchase functions & procedures ➢ State features of ERP & MRP 6.1 Inventory Concept, its classification, functions of inventory 6.2 ABC Analysis - Necessity & Steps 6.3 Economic Order Quantity Concept, graphical representation, determination of EOQ 6.4 Standard steps in Purchasing 6.5 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	08	08
Topic 7: Quality Management **Specific Objectives** ➢ State Principles of Quality Management ➢ Describe Modern Technique & Systems of Quality Management 7.1 Meaning of Quality Quality Management System - Activities, Benefits Quality Control - Objectives, Functions, Advantages Quality Circle - Concept, Characteristics & Objectives Quality Assurance - Concept, Quality Assurance System 7.2 Meaning of Total Quality and TQM Components of TQM - Concept, Elements of TQM, Benefits 7.3 Modern Technique & Systems of Quality Management like Kaizen,5'S',6 Sigma 7.4 ISO 9001:2000 - Benefits, Main clauses.	06	08
Total	**48**	**50**

Learning Resources:
Books:

Sr. No	Author	Name of Book	Publisher
01	Dr. O.P. Khanna	Industrial Engineering & Management	Dhanpat Rai & Sons New Delhi
02	Banga & Sharma	Industrial Engineering & Management	Khanna Publication
03	Dr. S.C. Saksena	Business Administration & Management	Sahitya Bhavan Agra
04	W.H. Newman E. Kirby Warren Andrew R. McGill	The process of Management	Prentice- Hall

E Source:

nptel.iitm.ac.in
http://iete-elan.ac.in/subjects/amIndustrialMgmt.htm

Course Name : Mechanical Engineering Group

Course Code : ME/MH/MI/PG/PT

Semester : Sixth for ME/PG/PT and Seven for MH/MI

Subject Title : Industrial Fluid Power

Subject Code : 17608

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	--	25#	25@	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

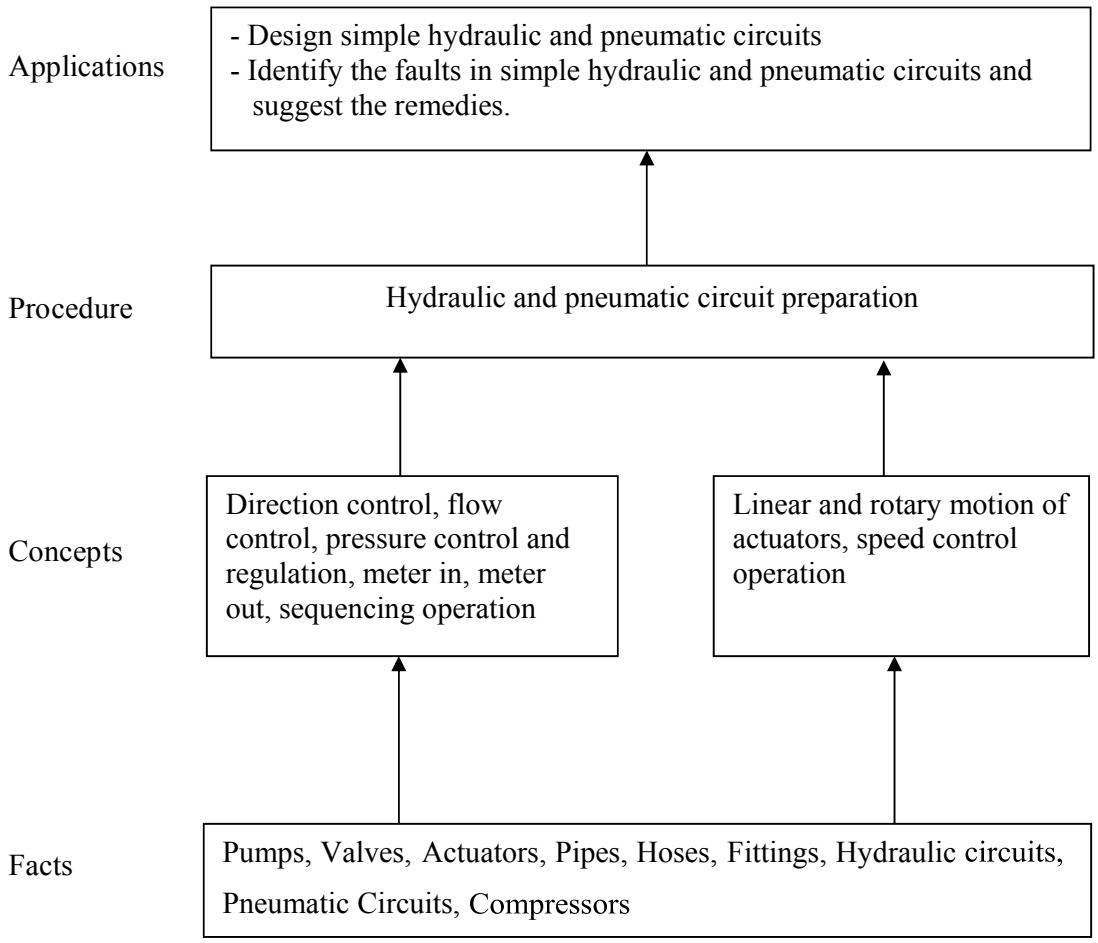
Rationale:

Oil hydraulic systems & pneumatic systems are widely used in all fields of engineering as clean source of motive power. Low cost automation systems with the use of pneumatics have become popular as manufacturing aids. Diploma engineers come across such systems in all the segments of industries. This subject will give the students, the basic skills and knowledge of oil hydraulics and pneumatics which will be directly needed in the industrial environment.

General Objectives: The student will be able to

1) Identify various components of hydraulic & pneumatic systems.
2) Know the working principle of various components used in hydraulic & pneumatic systems.
3) Select appropriate components required for simple hydraulic and pneumatic circuits.
4) List the probable causes of faults or defects in the hydraulic & pneumatic circuits.

Learning Structure:



Theory:

Topic & Content	Hours	Marks
1. Basics of Oil Hydraulic Systems 24 Marks Specific Objectives: ➢ Identify various components in simple oil hydraulic circuits. ➢ List the types of various components in simple oil hydraulic circuits. ➢ Explain the construction and working principle of various components in simple oil hydraulic circuits. Contents • General layout, Applications, Merits and limitations of oil hydraulic systems **06 Marks** • Overview of essential properties of oils used in oil hydraulic circuits **06 Marks** • Construction, working principle, applications and symbols of Vane pump, gear pump, Gerotor pump, screw pump, piston Pump **12 Marks**	16	24
2. Hydraulic Valves, Actuators and Accessories 24 Marks ➢ Select valves, actuators and accessories for the given application of hydraulic circuit. • **Valves 12 Marks** Construction, principle of working and symbols of Pressure control valves – pressure relief valve -direct, pilot operated , pressure reducing, pressure unloading, Sequence valves, counter balancing Direction control valves – Poppet valve, spool valve, 2/2, 3/2, 4/2, 5/3, methods of actuation. Types of different center positions. check valves, pilot operated check valves Flow control valves – pressure compensated, non pressure compensated flow control valve, • **Actuators 06 Marks** Classification of actuators Construction, working principle and symbols of Rotary Actuators - Hydraulic motors Linear Actuators – Cylinders - single acting, double acting, and their subtypes. Different mounting methods. • **Accessories 06 Marks** Construction, working principle and symbols of Pipes, Hoses, Fittings, Oil filters, Seals and gaskets, Accumulators	18	24
3. Oil Hydraulic Circuits 16 Marks Specific Objectives: ➢ Draw layout of oil hydraulic circuits. ➢ Explain working of oil hydraulic circuits. ➢ Develop oil hydraulic circuit for different applications. Contents: • 'Meter in' ,'Meter out', 'Bleed off', Unloading , two cylinder synchronizing, regenerative, counterbalance , dual pump unloading circuits. • Sequencing circuit – time dependent and pressure dependent	08	12

• Oil hydraulic circuits for milling machine, shaper machine,		
4. Introduction to and components of pneumatic systems **24 Marks** Specific Objectives: ➢ Identify various components in simple pneumatic circuits. ➢ List the types of various components in simple pneumatic circuits. ➢ Explain the construction and working principle of various components in simple pneumatic circuits. Contents: • Introduction **06 Marks** Applications of pneumatic systems General layout, merits and limitations of pneumatic systems Selection of air compressors for pneumatic circuits • Valves **08 Marks** Construction, principle of working and symbols of Pressure regulating valves, Direction control valves, Flow control valves • Actuators **06 Marks** Construction, working and symbols of Rotary Actuators - Pneumatic motors Linear Actuators – Cylinders - single acting, double acting. • Accessories **04 Marks** Construction, working and symbols of Pipes, Hoses, fittings, FRL unit	14	24
5. Pneumatic Circuits **16 Marks** Specific Objectives: ➢ Draw layout of simple pneumatic circuits. Contents: • Speed control circuits for double acting cylinder and bidirectional air motor **08 Marks** • Sequencing circuits - Position based sequencing circuit and time delay circuit **08 Marks**	08	16
Total	**64**	**100**

Practical:

Skills to be developed:

Intellectual Skills:

1. Prepare simple oil hydraulic & pneumatic circuits.
2. Compare the performance of oil hydraulic & pneumatic systems.
3. Identify the faults & suggest remedies in oil hydraulic & pneumatic circuits.
4. Select proper circuit for given application.

Motor Skills:

1. Connect different components in oil hydraulic or pneumatic circuit as per given drawing.
2. Perform repairing and / or replacement of defective components in the oil hydraulic or pneumatic circuit.
3. Draw the oil hydraulic and pneumatic circuits using symbols.

List of Practicals:

1. Assemble meter in and meter out oil hydraulic circuits and compare its working. List the applications
2. Assemble sequencing circuit and list its applications.
3. Assemble quick return mechanism oil hydraulic circuit for shaper machine.
4. Assemble pneumatic circuit for speed control of double acting cylinders.
5. Assemble pneumatic circuit for speed control of pneumatic motor and measure the speed of motor.
6. Study of trouble shooting procedures of various hydraulic and pneumatic circuits.
7. Selection of circuit components for simple oil hydraulic circuits such as circuits used for milling machine, shaper machine.

[Note - Term work shall consist of circuit diagram with ISO symbols, specifications and brief write up for all the above practicals. For practical no 1 - 5, the practical batch size shall be divided in two groups.]

Assignments -

1) Market survey of oils used for oil hydraulic circuits - collection of name of manufacturers, detailed technical specifications, trade names, costs, packing sizes
2) Study of any one mobile hydraulic system such as in earth moving equipments or any one stationary hydraulic system such as in any machine tool and its detailed report.
3) Study of any pneumatic circuit such as circuits used in special purpose machines, low cost automation systems, material handling systems and its detailed report.

[Assignments to be completed in a group of (max.) four students.]

Learning Resources:

1. Books:

Sr. No.	Author	Title	Publisher
01	Majumdar S.R	Oil Hydraulic system- Principles and maintenance	Tata McGraw Hill
02	Majumdar S.R	Pneumatics Systems Principles and Maintenance	Tata McGraw Hill
03	Joji B.	Pneumatic Controls	Wiley India Pub.
04	Stewart	Hydraulics and Pneumatics	Taraporewala Publication

2. Catalogues:

Various system components' manufacturers' catalogues.

3. CDs:

CDs developed by various system components' manufacturers

Course Name : Mechanical Engineering Group

Course code : ME/PG/PT/MH/MI/FG/FE

Semester : Sixth for ME/PG/PT/FG and Seventh for MH/MI/FE

Subject Title : Production Engineering & Robotics

Subject Code : 17609

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
04	--	--	03	100	--	--	--	100

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work. (SW)**

Rationale:

This subject is technology subject. A technician is required to work at the highest productivity level. His /her productivity depends on the productivity of two important resources i.e. human resource and equipment resource in the manufacturing system. Hence he/she should learn the techniques for improvement in productivity of these two resources.

A technician is required to plan the production schedule. He / She is required to organize material supply for the manufacturing activities. The total cost of goods produced contains expenditure incurred on material and human resources. The direct and indirect cost of scarce resources can be reduced by the technician by optimizing their use. . Hence he / she should learn, process planning, production planning and control.

Modern manufacturing system employs latest techniques such as JIT, TPM, FMS, 5'S', Kaizen. To keep pace with time, the technician should know all these techniques.

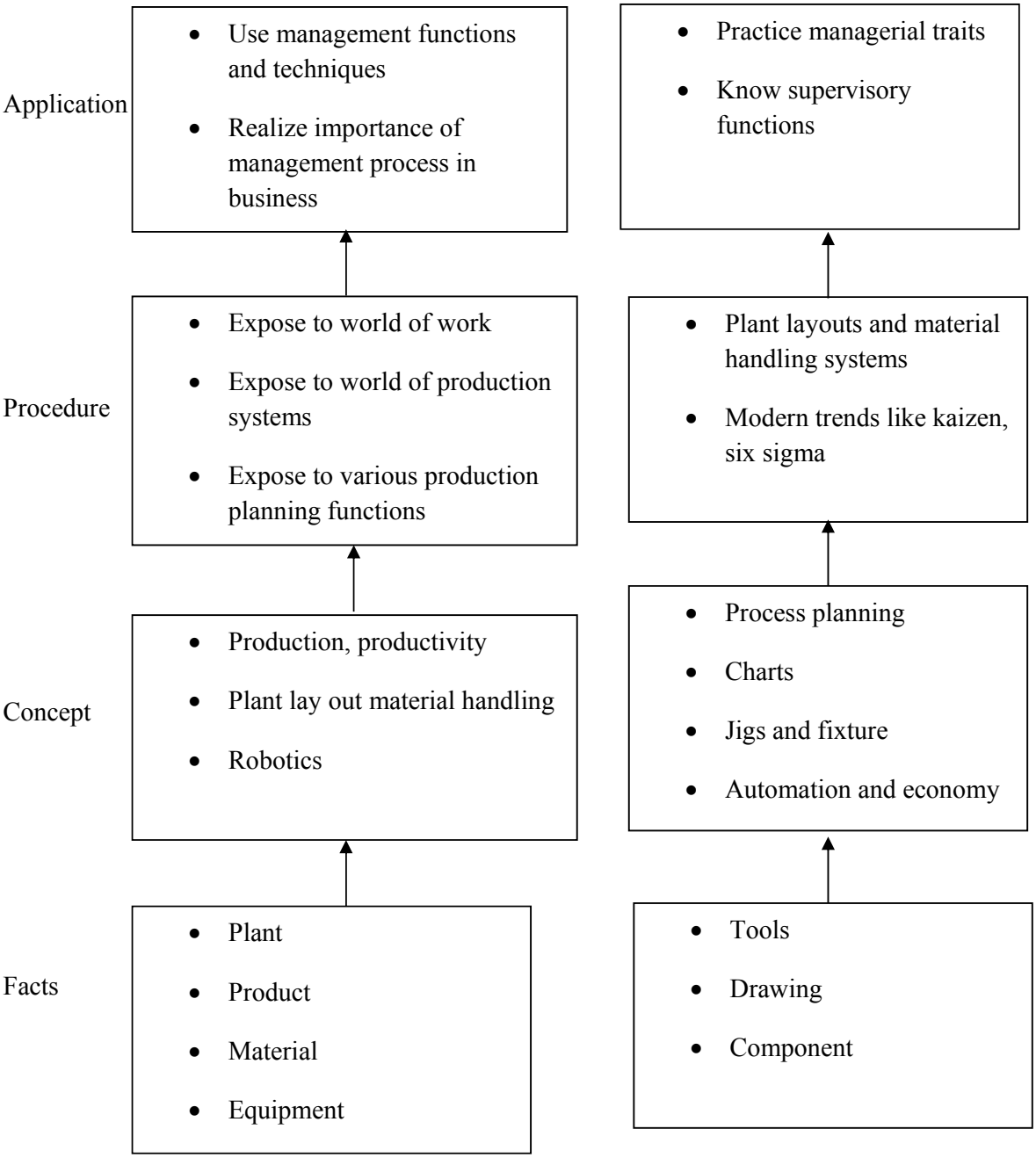
Industrial Robots are going to perform important and difficult functions in modern production system. A technician is expected to be aware of robots and their functioning.

General Objectives:

Students will be able to;

1. Understand importance of productivity and factors for improvement of productivity.
2. Know different production systems and modern trends in manufacturing systems.
3. Apply modern tools in production engineering like six sigma, kaizen, poka yoke, etc.
4. **U**nderstand concept of robotics, limitations of human in difficult operation and applications of robots.

Learning Structure:



Theory:

Topic and Content	Hrs.	Marks
1. **Production System** **Specific Objectives:** ➢ Define productivity ➢ State methods to improve productivity **Content:** 1.1 Production – definition ,types of production systems **04 Marks** 1.2 Productivity – importance, measurement of productivity, techniques of improving productivity. **04 Marks**	06	08
2. **Plant Location, Plant Layout and Material Handling** **Specific Objectives:** ➢ Draw layouts for manufacturing unit. ➢ State principles of material handling. ➢ Correlate plant layout and material handling. **Content:** 2.1 Plant Location - Importance of site selection, factors affecting site selection, Government policies, relaxation for backward areas**. 04 Marks** 2.2 Plant Layout - objectives, types, design principles, characteristics of plant layout, symptoms of bad plant layout. **04 Mark**s 2.3 Material handling – need, principles and types of material handling devices – conveyor, hoist & crane, forklift truck, trolley, pipe, selection of material handling systems and devices**.** Automated Guided Vehicles **06 Marks**	10	14
3. **Process planning** **Specific Objectives:** ➢ Prepare process sheet for any given component. ➢ Select machine tool for given manufacturing process. **Content:** 3.1 Planning of processes from raw material to finished product, factors affecting process planning, **08 Marks** 3.2 Deciding sequence of operations, operation sheet, combined operations, and determination of inspection stages. **08 Marks**	10	16
4. **Production planning and control (PPC)** **Specific Objectives:** ➢ State importance of PPC system in industry. ➢ Describe techniques of production control. **Content:** 4.1 Definition ,functions and importance of PPC, Meaning of Control, Progressive Control **06 Marks** 4.2 Gantt chart, Flow Process Sheet, Line balancing, **06 Marks**	06	12
5. **Work study** **Specific Objectives:** ➢ Calculate standard time for given activity ➢ Prepare process chart **Content:** 5.1 Method Study- Definition, Objectives, Procedure, Selection of work. **04 Marks** 5.2 Recording Techniques:- Process Charts – Outline process chart, Flow process chart, Two Handed process chart, Multiple activity	08	12

Chart, Flow diagram, String diagram, Travel chart. **04 Marks** 5.3 Work Measurement – Objectives, procedure, Time Study, Time Study Equipments. Stop Watch Time Study, Allowances, Calculation of Standard Time, **04 Marks**		
6. **Jigs and fixtures** **Specific Objectives:** ➢ Understand importance and use of jigs and fixtures in industries ➢ Understand principles of jig and fixture design and design a jig/fixture for given component **Content:** 6.1 Introduction. Difference between jig and fixture, Different components of Jig/ fixture, Types of jigs and fixtures. **04 Marks** 6.2 Types of locators and clamping devices, 3-2-1 principle of location, Fool proofing of jigs and fixture, General principles of jig and fixture design. **08 Marks**	08	12
7. **Modern trends in production engineering** **Specific Objectives:** ➢ Describe kaizen technique. **Content:** 7.1 Just In Time manufacturing – Pull and push types of manufacturing systems. Waste management technique, Concept of ERP. **06 Marks** 7.2 Basic concepts of ➢ Kaizen ➢ Concept and meaning of 5S ➢ Lean manufacturing **04 Mark**	06	10
8. **Robotics** **Specific Objectives:** ➢ State concept of robotics ➢ State limitations of human in difficult operation ➢ State applications of robots. **Contents:** 8.1 Robotics - Introduction, Robot anatomy and structure, specification, working and basic components, Various configuration, Degree of freedom and application**.** **04 Marks** 8.2 Sensors - Classification, Basic configuration. **04 Marks** 8.3 Power sources for robotics, Actuators - Mechanical, Electrical, Hydraulic, and Pneumatic. **04 Mark**s 8.4 Concept of grippers - Screw and vacuum actuated gripper, end effectors. **04 Marks**	10	16
Total	**64**	**100**

Learning Resources:
Books:

Sr. No.	Author	Name of Book	Publication
1	L.C. Jhamb	Industrial Management	Everest
2	James C. Rigs	Production System, Planning, Analysis & Control	N.Y.Wiley & Sons

3	O.P. Khanna	Industrial Engineering and Management	Dhanpat Rai & Sons
4	P. H. Joshi	Jigs & Fixtures	Tata McGraw Hill
5	Taiichi Ohno	Toyota Production system	Productivity Press
6	Richard D.Klafter Michael Negin	Robotic Engineering	P.H.I
7	C.Ray Asfahl	Robots and Manufacturing Automation	John Wiley and Sons.
8	R.K. Rajput	Robotics & industrial Automation	S Chand.

Course Name : Diploma in Production Technology / Diploma in Production Engineering

Course code : PG / PT

Semester : Sixth

Subject Title : Automobile Engineering and Manufacturing

Subject Code : 17614

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
04	--	02	03	100	--	--	25@	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

Automobile manufacturing system is an applied technology. This course in production engineering will allow students to apply their knowledge about various Automobile manufacturing systems, sub systems and their relationship with sense of manufacturing technology.

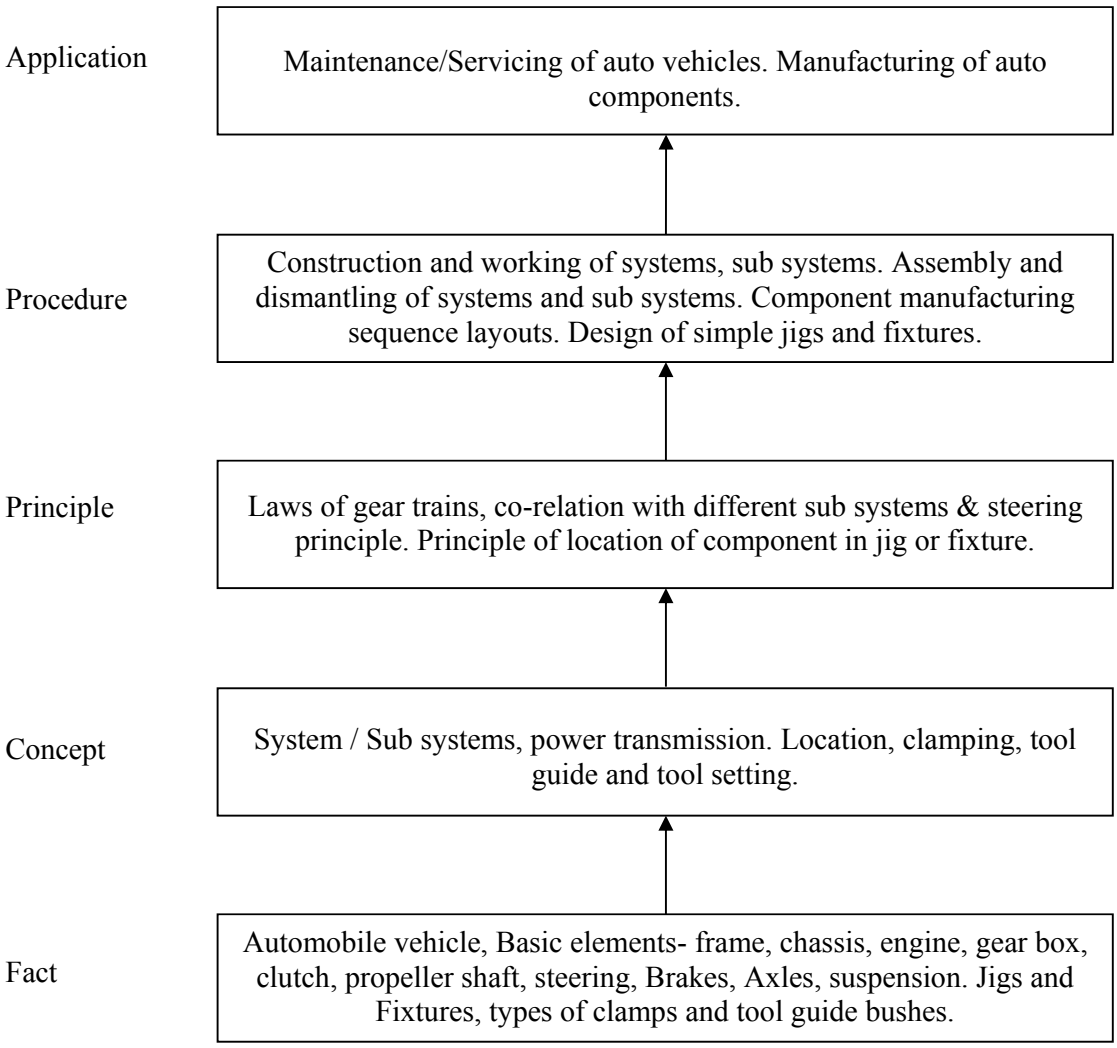
In the era of globalization, all the major global players in the automobile manufacturing sector have launched their plants in India. To meet their demand of skilled man power the diploma holders plays a vital role.

Objectives:

The student will be able to

1. Understand working of various automotive systems & sub systems.
2. Understand various manufacturing processes for automobile components.
3. Prepare process plan and specify tooling for manufacturing of simple components.
4. Design simple Jigs and Fixtures.

Learning Structure:



Theory:

Topic and Content	Hrs.	Marks
1. Introduction to automobile **Specific Objective:** ➢ Classify automobile vehicles. ➢ State functions of given automobile component. **Content:** 1.1 Classification of automobiles vehicle, layouts of automobile vehicles with components and their functions. **04 Marks** 1.2 Types of chassis, construction of body, body nomenclature, body shop painting, and introduction to aerodynamic body shapes. **04 Marks**	05	08
2. Automobile transmission **Specific Objective:** ➢ Describe components of automobile transmission system. ➢ Describe working of propeller shaft. **Content:** 2.1 Clutch - Necessity, construction and working of coil Spring & diaphragm spring type clutch**.** **06 Marks** 2.2 Gear Box- Types, construction and working of constant mesh, synchromesh, epicyclic gear box, overdrive, double declutching**.** **06 Marks** 2.3 Final Drive – Necessity, construction and working of Propeller shaft and differential**.** **04 Marks** 2.4 Types of rear axle and front axle with their functions and applications. **04 Marks**	12	20
3. Control systems **Specific Objective:** ➢ State working principle of power steering. ➢ Describe construction and working of hydraulic brake. **Content:** 3.1 Steering systems: necessity, Constructions & working of steering linkages. Types of steering gear box, rack &pinion steering gear, re-circulating ball bearing with Construction and working. working principle of power steering, steering geometry, Camber, Caster, Toe-in, Toe-out, King pin inclination & their effects**.** **08 Mark** 3.2 Brake Systems: necessity, Types, Construction & Working of hydraulic brake, pneumatic brake, drum brake and disc brake with their advantages and disadvantages**.** **08 Marks**	10	16
4. Suspension system **Specific Objective:** ➢ Classify suspension systems ➢ Describe construction of telescopic shock absorber. **Content :** 4.1 Necessity, Classification**,** construction and working of rigid axle, independent suspension system. **08 Marks** 4.2 Construction & working of McPherson, wishbone &Trailing link suspensions. **04 Marks** 4.3 Construction & working of telescopic shock Absorbers. **04 Marks**	09	16
5. Manufacturing Major Automobile Components **Specific Objective:** ➢ Describe manufacturing processes of crank shaft. **Content:**	14	20

5.1 Car body manufacturing- Sheet metal cutting, forming, welding, joining, painting and finishing. **04 Marks** 5.2 Cylinder block- Casting, machining and finishing, Piston- die casting, Heat treatment & machining, Liners- casting, Heat treatment & machining. **04 Marks** 5.3 Connecting Rod: Forging, machining, heat treatment, Broaching **04 Marks** 5.4 Crank shaft- Forging, machining, heat treatment, grinding, lapping& dynamic balancing. **04 Marks** 5.5 Leaf Spring- cutting, drilling, hardening, tempering, bending, pre-stressing & protective coating, Final assembly and painting. **04 Marks**		
6. Process planning and Jig/Fixture Design **Specific Objective:** ➢ Design of Jig for an automobile component. ➢ Design of Fixture for an automobile component. **Content:** 6.1 **Introduction** **04 Marks** Principles of Jig and fixture design, Locating devices, types of locators for different types of surfaces and shapes, design considerations for jig and fixture design and steps to be followed. 6.2 **Design of Drilling Jig** – features and applications of different types of drilling jigs- plate jig, angle plate jig, box jig, tumble jig, universal jig. Design process for a simple jig. **08 Marks** 6.3 **Design of Milling Fixture** – essentials of milling fixtures - Tennon pins, setting block, types of fixtures, special clamping devices. Design process for a simple fixture. **08 Marks**	14	20
Total	**48**	**100**

Practical:
Skills to be developed..
Intellectual skills

1) Follow sequence of dismantling and assembling.
2) Use of service manual for information search.

Motor Skills

1) Use of instruments for dismantling and assembling.
2) Carry out maintenance as per users manual.

List of Practical:

1) Carry out automobile engine maintenance of four wheeler or two wheeler as per manufacturer's specifications.
2) Demonstration on working of single plate coil spring or diaphragm spring clutch. Sketch and describe its construction.
3) Demonstration on differential gear box. Sketch and describe its construction.
4) Demonstration of rack and pinion steering gearbox. Sketch and describe its construction.

5) Write a report on visit to an Automobile Manufacturing / Ancillary industry or service centre and write report on rigid axle, hydraulic and pneumatic braking system

6) Prepare a process plan for a simple automobile component.

7) Design of Jig for a simple automobile component.

8) Design of Fixture for a simple automobile component.

Learning Resources:

Books:

Sr. No.	Title	Author	Publication
1	Automobile Engineering	Kirpal Sing	Standard Publication
2	Automobile Engineering	G.B.S. Narang	Khanna Publishers Delhi
3	Automotive Mechanics	Willian Crouse, D. L. Anglin	Tata McGraw Hill
4	Automotive Technology	H.M. Sethi	Tata McGraw Hill
5	Automotive Engines	James D.Halderman Chase D.Mitchell	Pearson Education
6	Jigs & Fixtures	P. H. Joshi	Tata McGraw Hill
7	Production Engineering	P.C. Sharma	S. Chand Publications
8	Industrial Engineering and Management	O.P. Khanna	Dhanpat Rai & Sons
9	Production Technology	R K Jain S C Gupta	Khanna Publishers, Delhi

Course Name : Diploma in Production Technology / Diploma in Production Engineering

Course code : PG / PT

Semester : Sixth

Subject Title : Tool Design

Subject Code : 17615

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS.	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	25#	25@	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

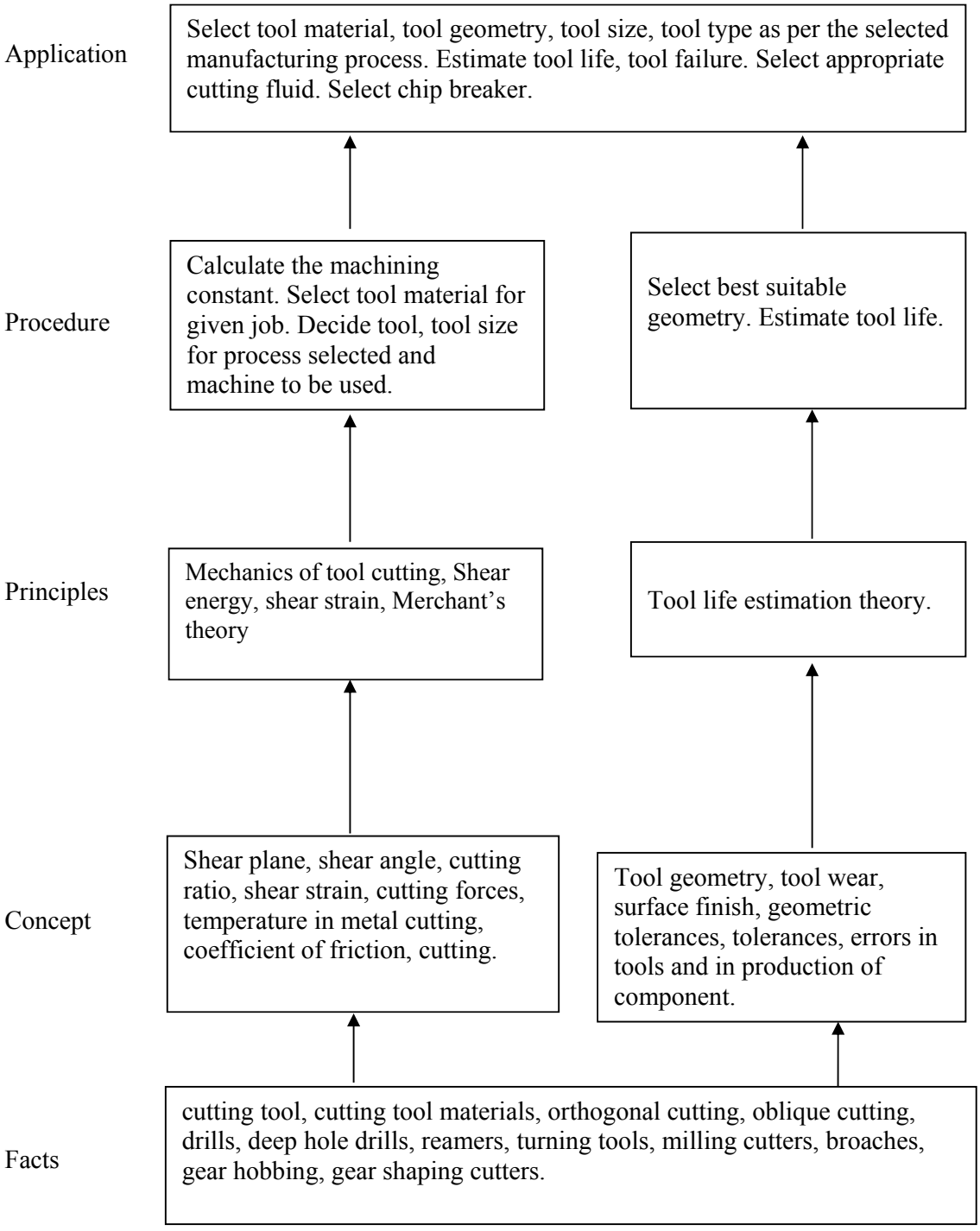
This subject is classified as technology subject. It is intended to impart, concepts, principles & procedures of tool design to the students so that they can understand the procedure of tool design to achieve highest productivity and perform duties as a technician in tool room, shop floor & assist tool Engineer in design of tools and production processes.

Objective:

The students will be able to:

1. Know methods of referring data book and manufacturer's catalog.
2. Select cutting tools and its material using data book and manufacturer's catalogue.
3. Understand methods of estimating tool wear and tool life.
4. Apply principle of press tools and dies.
5. Design strip layout for given component.
6. Know appropriate cutting fluid for machining process improvement.

Learning Structure:



Theory:

Topic and Content	Hrs.	Marks
Topic 1. Metal Cutting **Specific Objectives:** ➢ State the types of chips in the cutting process. ➢ Calculate cutting forces on single point cutting tool. **Content:** **1.1** Mechanics of Metal cutting: requirements of tools, cutting forces – Merchant circle, types of chips, chip thickness ratio, shear angle - simple numerical only, types of metal cutting process - orthogonal, cutting. **14 Marks** **1.2** Cutting fluids – types, characteristics and applications. **04 Marks** **1.3** Cutting Tool Geometry: Single point cutting tool. **06 Marks**	12	24
Topic 2. Tool Material and Tool Wear **Specific Objectives:** ➢ State types of tool materials and tool wear. ➢ Describe process of tool wear. ➢ Select tool for machining operation. **Content:** **2.1** Tool materials: Types, characteristics, applications. Heat treatment of tool steels, Specification of carbide tips, Types of ceramic coatings. **10 Marks** **2.2** Tool wear - Types of wear, Tool life - Tool life equations. Factors affecting tool wear /tool life. **06 Marks**	08	16
Topic 3. Press Tools and dies **Specific Objectives:** ➢ State different types of presses. ➢ Describe die components. ➢ Calculate punch and die size for cutting operation. **Content:** **3.1 Presses:** Introduction of Types of presses, Specification for OBI presses only. **04 Marks** **3.2 Types of dies and construction:** Simple Die, Compound Die, Progressive Die, and Combination Die. Punch & die mountings, pilots, strippers, misfeed detectors, Pressure Pads, Knock outs, stock guide, Feed-Stop, guide bush, guide pins, Die set, Die shoe. Strip layout, Calculation of material utilization factor **12 Marks** **3.3 Die Design Fundamentals:** Die Operations- blanking, piercing, shearing, cropping, notching, lancing, coining, drawing, bending **04 Marks** **3.4** Calculation of clearances on dies and punches for blanking and piercing dies. **08 Marks**	14	28
Topic 4. Forming Dies **Specific Objectives:** ➢ State different types of forming operations and dies. ➢ Calculate blank size for bending and drawing operation. **Content:** **4.1** Bending: methods, Bending Dies, bend allowance, spring back, spanking, bending pressure, pressure pads, and development of blank length. **10 Marks** **4.2** Drawing: types of drawing dies, Metal flow during drawing, variables affecting metal flow during drawing, Calculation of Drawing blank size and number of draws. **12 Marks**	10	22
Topic 5. Fundamentals of Other Types of Dies **Specific Objectives:**	04	10

➢ Describe dies for die casting, forging and extrusion. **Content:** Constructional features of - Pressure Die casting dies, metal extrusion dies, forging dies.		
Total	**48**	**100**

Practical:

Intellectual Skills:

1. Develop ability to sketch
2. Analyse the problem and find solution.
3. Design of die.

Motor Skills:

1. Draw strip layout.
2. Prepare drawings for given components of die.

List of Practical / Assignment:

1. Calculate cutting forces and shear angle based on Merchant's circle for two given problems.
2. Draw sketches of combination die, progressive die, compound die, inverted die, drawing die, bending die.
3. Draw strip layout of simple component (Different component for every student), and calculation of material utilization factor.
4. Draw sketches of pressure die casting and forging die.
5. Calculate blank length for bending operation and blank size for single stroke drawing operation.
6. Select designation of carbide tools for given machining operations, by referring data book / catalogs.
7. Draw sketches and describe types of punches, strippers and pilots.
8. Design of blanking die - Drawing sheets showing assembly & details for a given component.
9. Write report on visit to press shop for study of presses.

Learning Resources:

Books:

Sr. No.	Author	Title	Publisher
01	Donaldson Anglin	Tool Design	Tata McGraw Hill
02	P. C. Sharma	A Text Book OF Production Engineering	S Chand & Co.
03	H. M. T.	Production Technology	Tata Mc Graw Hill
04	R. K. Jain	Production Technology	Khanna Publishers
05	A.S.T.M.E.	Fundamental of tool design.	Prentice-Hall of India.
06	P. H. Joshi	Press Tools	Tata Mc Graw Hill
07	Nagpal	Tool Design	Khanna Publications

Course Name : Mechanical Engineering Group

Course Code : ME/PG/PT/MH/MI

Semester : Sixth for ME/PG/PT and Seventh for MH/MI

Subject Title : Solid Modeling

Subject Code : 17063

Teaching and Examination Scheme

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	--	02	--	--	25#	--	25@	50

Rationale:

Technically 3 dimensions refers to objects that are constructed on 3 planes (X,Y,Z). The process of creating 3 dimensional (3D) computer graphics can be divided into 3 basic phases - 3D modeling, 3D animation & 3D rendering. 3D models means solid model is usually originated on the computer by engineer using some kind of solid modeling softwares. Solid modeling is a process of developing a mathematical representation of any 3 dimensional object. The solid model may be created using solid modeling softwares. Solid models are often animated for some uses.

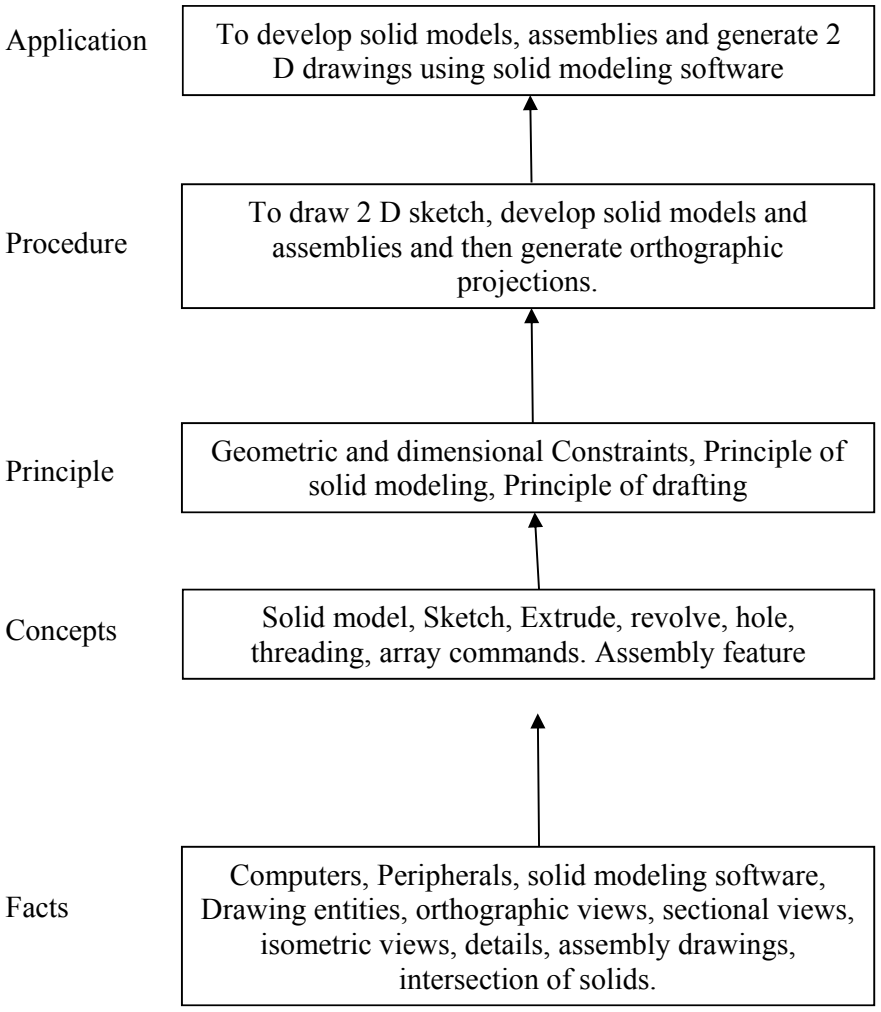
Today 3D models are used in wide variety of engineering fields. Three dimensional computer graphics are widely used for product design, assembly design etc. As a diploma engineer he should have the knowledge of solid modeling software to visualize the machine components & assembly like cars, machine tools and earth movers etc.

General Objectives:

Students will be able to

1) Use appropriate commands
2) Develop solid models from 2 D drawing.
3) Use of printers / plotters.

Learning Structure:



Theory:

Topic and Content	Hours
1: Introduction to Solid Modeling **Content:** Introduction, Applications, Benefits, Need, Hardware Requirements, Different Software packages used for Solid Modeling.	02
2: Working in 2 D environment **Content:** **2.1 Working in Sketcher mode** – Line, Profile, Circle, Arc, Rectangle and their sub options. **2.2 Constraints** - Dimensioning constraint, Geometrical constraint.	02
3: Creation of solid models **Content:** **3.1 Working in 3 D environment** -Creating 3D Solid Models of simple machine parts. **3.2 Intersection of solids** – Intersect 2 solid components by inserting new body option, Boolean operations – Union, subtract, intersection.	04
4: Assembly Drawing **Content:** **4.1 Assembly Drawing** - Preparation of Assembly drawing by using assembly features. (Assembly of minimum 4-5 components) **4.2 Exploded view** – Explode the assembly.	04
5: Working in Drafting Mode **Content:** **5.1 Orthographic projections** – Generate orthographic projections which will include all types of views – front view, top view, side view, sectional views, isometric views, auxiliary views. **5.2 Dimensioning Commands** – Apply dimensions, dimensional and geometrical tolerances. **5.3 Bill of material** – Prepare part list table and name plate	03
6: Plotting drawing **Content:** Page set up, Plot command.	01
Total	**16**

Note: Multimedia projection facility shall be used during lecture sessions along with computer facility e.g. laptop, computer, LCD projector.

Practical:
Skills to be developed

Intellectual skills:

1) Interpret a drawing to draw in solid Modeling software.
2) Use command dialogue box.

Motor Skills:

1) Use toolbars.
2) Use printers or plotters.

Guideline for Practical:

1) One student per computer terminal.
2) For assembly drawing practical work select any one assembly like oldham's coupling, cotter Joint, knucle Joint, stop valve, piston and cylinder assembly, lathe tool post, bearing block assembly, screw jack, tail stock etc.

List of practicals:

1. Creation of minimum 4 different 2 D sketches
2. Creation of at least 5 solid models using solid modeling features.
3. Creation of 2 assembly drawings each of at least 5 components.
4. Generation of orthographic projections front view, top view, side view, isometric view.
5. Generation of sectional view.
6. Generation of auxiliary view.
7. Intersection of solids (at least 2 assignments)
8. Plotting of above drawings on A2/A3 size sheet.

Note: Use of any one Solid Modeling Software of Latest Version is recommended.

Practical Examination: (2 Hours for each student)
Creation of 3D Model and their 2 D views from the given part drawing followed by oral examination based on above term work. (One candidate on one computer terminal.)

Course Name : Mechanical Engineering Group

Course Code : AE/ME/MH/PG/PT/FE/FG

Semester : Sixth for AE/ME/PG/PT/FG and Seventh for MH/MI/FE

Subject Title : Project

Subject Code : 17090

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	04	--	--	--	50#	50@	100

Rationale:

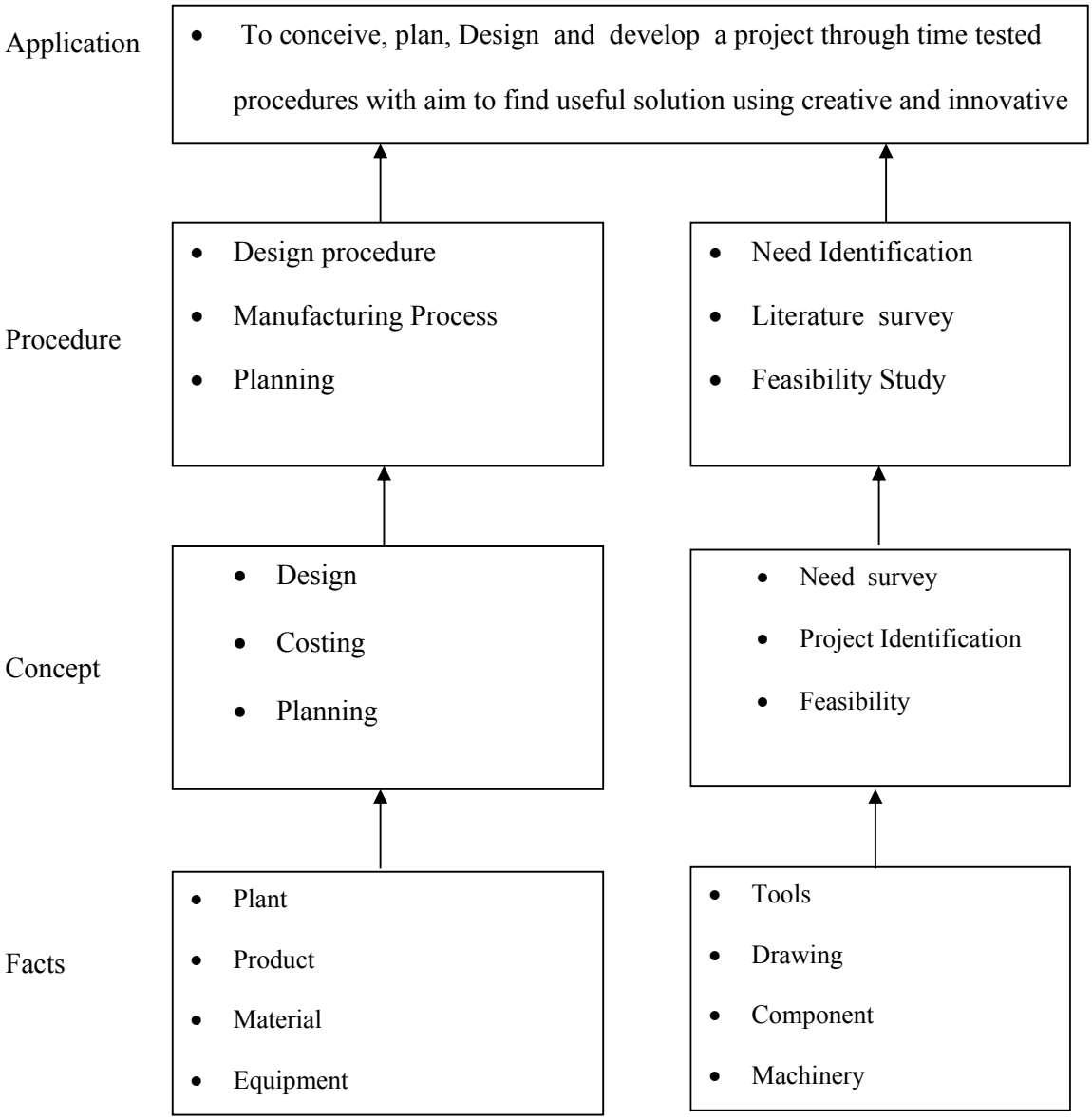
Project work allows students to use their creative and innovative ideas translating in working model, prototypes, and equipments and developing necessary hands on skills. This will allow the students to apply the previous knowledge and skills acquired during the course.

General Objectives:

The student will be able to:

1. Analyze the given problem.
2. Generate alternative solutions to the problem.
3. Compare & select feasible solutions amongst alternative generated.
4. Develop and manufacture new/modified equipments.
5. Acquire technical knowledge beyond curriculum.

Learning Structure:



Content:

Following activities related to project are required to be dealt with, during this semester

1. The Selection and preliminary work regarding Project to be done as per directives given in **PROFESSIONAL PRACTICES – V** Curriculum.
2. The identified projects be executed during the semester as per the Guidance from the project Guide by the group of students (Group size max. 4 students).
3. Maintain the project diary individually for the activities performed in the format specified below.

Project Diary format:

Sr. No.	Date	Activity Carried out	Remarks	Signature of Guide

SUGGESTED PROJECT WORK AREAS

1) Fabrication of small machine / devices/ test rigs/ material handling devices/ jig & fixtures/ demonstration models, etc.
2) Design & fabrication of mechanisms, machines, Devices, etc.
3) Development of computer program for designing and /or drawing of machine components, Simulation of movement & operation, 3D modeling, pick & place robots
4) Industry sponsored projects- project related with solving the problems identified by Industry should be selected. (One person from industry is expected to work as co- guide along with guide from institution).
5) Literature survey based projects: Project related with collection, tabulation, classification, analysis & presentation of the information. Topic selected must be related with latest technological developments in mechanical field, and preferably beyond curriculum.
6) Modification in the existing machinery / equipment for improved performance.
7) Maintenance based projects.
8) Industrial engineering based project: Project based on work study, method study, methods improvement, leading to productivity improvement.
9) Low cost automation projects.
10) Innovative/ Creative projects involving generation of new ideas and converting it into a model, gadget.
11) Market survey based projects.
12) Project based on use of appropriate technology particularly benefiting rural society or economically weaker section.
13) Equivalent level project can be selected from other than the area specified above.

Note:

Project should provide viable and feasible solution to the problem identified.
Report should be of 40TO 50 pages.
Font size of project report contents be as follows:

1. Main title: 16 bold Times new roman
2. Sub titles: 14 bold Times new roman
3. Running matter: 12 Times new roman, paragraph 1.5 line spacing,
4. Margin spacing 1.5 inch from left and 1 inch from other sides.

Preferably actual photographs / video clips showing progress of project work at different stages be added to project report).
Suggested framework for the project report:

The topics/ contents of the project report should be as follows:-

- Abstract
- Topic introduction/ Philosophy
- Literature Survey/ Methodology adopted
- Principle (aim objectives of the Project work)
- Data collection/ Design consideration/Basic Framework/Design / Drawing
- Manufacturing Processes and Process Sheets (if relevant)
- Assembly (if relevant)
- Performance / Calculations etc (If relevant)
- Costing
- Results and Discussion
- Conclusion
- Future Scope
- Bibliography/ References

Learning Resources:
Reference Books:

Sr. No.	Name of Book	Author	Publisher
1	Project Management	Maylor	Pearson Education
2	Project Management And Appraisal	Khatua	Oxford University Press
3	Project Management/2/e	Bhavesh Patel	Vikas Publishing House
4	Project Management 3/e	Vasant Desai	Himalaya Publishing House
5	Project Management The Managerial Approach	Gray	TMH

Course Name : Mechanical Engineering Group

Course Code : AE/ME/PG/PT/MH/MI

Semester : Sixth for AE/ME/PG/PT/FG and Seventh for MH/MI/FE

Subject Title : Entrepreneurship Development

Subject Code : 17099

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
01	01	--	--	--	--	--	25@	25

Rational:

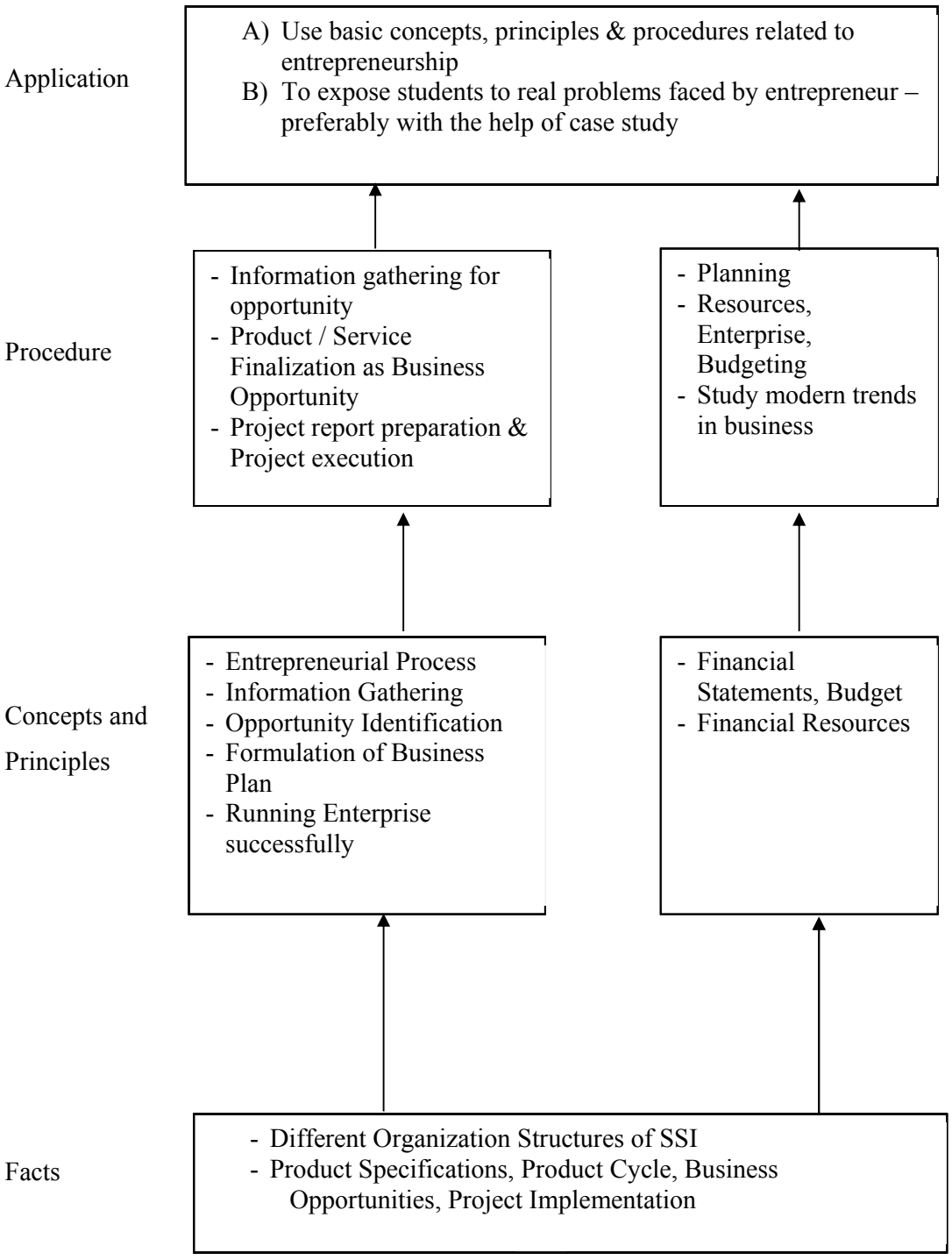
Globalization, liberalization & privatization along with revolution in Information Technology, have thrown up new opportunities that are transforming lives of the masses. Talented and enterprising personalities are exploring such opportunities & translating opportunities into business ventures such as- BPO, Contract Manufacturing, Trading, Service sectors etc. The student community also needs to explore the emerging opportunities. It is therefore necessary to inculcate the entrepreneurial values during their educational tenure. This will help the younger generation in changing their attitude and take the challenging growth oriented tasks instead of waiting for white-collar jobs. This subject will help in developing the awareness and interest in entrepreneurship and create employment for others.

General Objectives:

The students will be able to

1) Appreciate the concept of Entrepreneurship
2) Identify entrepreneurship opportunity.
3) Develop entrepreneurial values and attitude.
4) Collect and use the information to prepare project report for business venture.
5) Develop awareness about enterprise management.

Learning Structure:



Content:

Topic and Contents	Hours
1. Entrepreneurship, Creativity & Opportunities **Specific objectives:** ➢ Know the characteristics of entrepreneur and business **Contents:** 1.1 Concept, Classification & Characteristics of Entrepreneur 1.2 Creativity and Risk taking. 1.3 Business types and Reforms 1.4 SWOT Analysis	03
2. **Information and Support Systems for Development of Entrepreneurship** **Specific objectives:** ➢ Know the various information sources and support systems **Contents:** 2.1 **Information Sources:** Information related to project, procedures and formalities 2.2 **Support Systems** 1) Business Planning & Requirements for setting up an SSI 2) Govt. & Institutional Agencies (Like MSFC, DIC, MSME, MCED, MSSIDC, MIDC, LEAD BANKS) Statutory Requirements and Agencies.	03
3. **Market Assessment and feasibility** **Specific objectives:** ➢ Know the market requirement and customer needs through survey and feasibility analysis **Contents:** 3.1 Marketing -Concept and Importance, Market Identification. 3.2 Customer need assessment, Market Survey, Product feasibility analysis	02
4. Business Finance & Accounts **Specific objectives:** ➢ Know the basics of elements of costing, financial resources and business accounting procedure **Contents:** 4.1 **Business Finance:** Costing basics, Sources of Finance, Break Even Analysis. 4.2 **Business Accounts:** Book Keeping**,** Financial Statements, Financial Ratios and its importance, Concept of Audit.	03
5. **Project Report Preparation** **Specific objectives:** ➢ Understand and plan the steps in starting the business ➢ Prepare project report and carry out project feasibility study **Contents:** 5.1 Business plan: Steps involved from concept to commissioning 5.2 **Project Report** 1) Meaning and Importance 2) Components of project report/profile 5.3 **Project Feasibility Study:** 1) Meaning and definition 2) Technical, Market, Financial feasibility	03
6. **Enterprise Management And Modern Trends** **Specific objectives:** ➢ Know the role of entrepreneur in management of enterprise ➢ Understand the concept of E-Commerce **Contents:**	02

6.1 **Enterprise Management** 1) Essential roles of Entrepreneur in managing enterprise 2) Probable causes of sickness 6.2 E-Commerce: Concept and process 6.3 Global Entrepreneur	
Total	**16**

Tutorial:

Sr. No	Assignments
1	Assess yourself-are you an entrepreneur?
2	An Interview with an Entrepreneur.
3	Feasibility study of a product.
4	Prepare a Project Report for starting a small scale business.

Note - A teacher shall guide the students during tutorial periods for writing the above assignments**.**

Learning Resources:

1) Reference Books:

Sr. No.	Name of Book	Author	Publisher
1	Entrepreneurship	Trehan	Dream Tech Press
2	Entrepreneurship 2/e	Rajeev Roy	Oxford University Press
3	Entrepreneurship and Small Business	Schaper	Wiley India Publication
4	Entrepreneurship Development	Colombo plan staff college for Technical education.	Tata McGraw Hill Publishing co. ltd. New Delhi.
5	Poornima M. Charantimath	Entrepreneurship Development of Small Business Enterprises	Pearson Education
6	Entrepreneurship Development	E. Gorden K.Natrajan	Himalaya Publishing. Mumbai

2) Video Cassettes:

Sr. No.	SUBJECT	SOURCE
1	Five success Stories of First Generation Entrepreneurs	EDI STUDY MATERIAL Ahmedabad (Near Village Bhat , Via Ahmadabad Airport & Indira Bridge), P.O. Bhat 382428 , Gujrat,India P.H. (079) 3969163, 3969153 E-mail: ediindia@sancharnet.in/olpe@ediindia.org Website : http://www.ediindia.org
2	Assessing Entrepreneurial Competencies	
3	Business Opportunity Selection and Guidance	
4	Planning for completion & Growth	
5	Problem solving-An Entrepreneur Skill	