

Diploma in Mechanical Engineering

V Semester

	Course Code	Course Name	Teaching Scheme					Examination Scheme						
			Instruction periods per week			Total Periods per semester	Credits	Continuous internal Evaluation(CIE)			Semester end examination (SEE)			
			L	T	P			Mid Sem 1	Mid Sem 2	Internal Evaluation	Max marks Min marks		Total Marks	Min marks for passing including CIE
1	18M-501C	Industrial Management and Entrepreneurship	3	1	0	60	3	20	20	20	40	14	100	35
2	18M-502C	DESIGN OF MACHINE ELEMENTS	3	1	0	60	3	20	20	20	40	14	100	35
3	18M-503C	CAD/CAM	3	1	0	60	3	20	20	20	40	14	100	35
4	18M-504E	A) Industrial engineering B) Estimating and costing	3	1	0	60	3	20	20	20	40	14	100	35
5	18M-505E	A) Refrigeration and Air Conditioning B)Fluid power engineering	3	1	0	60	3	20	20	20	40	14	100	35
6	18M-506P	CAM LAB	1	0	2	45	1.5	20	20	20	40	20	100	50
7	18M-507P	Advanced Manufacturing & Fabrication Engineering Lab	1	0	2	45	1.5	20	20	20	40	20	100	50
8	18M-508P	Refrigeration and Air Conditioning Lab	1	0	2	45	1.5	20	20	20	40	20	100	50
9	18M-509P	C Programming lab	1	0	2	45	1.5	20	20	20	40	20	100	50
10	18M-510P	Project work	0	0	3	45	1.5	20	20	20	40	20	100	50
11		Skill Upgradation	0	0	7	105	2.5	0	0	Rubrics			--	-
		TOTAL	19	5	18	630	25	200	200	200	400	170	1000	425
	Activities: student performance is to be assessed through Rubrics													

TEACHING AND EXAMINATION SCHEME

Note: Pass criteria: The minimum marks required for passing in any of courses are given below

1. Cumulative 35% of marks (35 marks) in Mid Sem -1 + Mid Sem -2+ Internal Evaluation +SEE
2. Minimum marks in SEE is 35% (i.e.14marks).
3. If the cumulative of CIE is less than 35% (i.e.21 marks out of 60) then more than 35% of SEE is required to get overall 35%.

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Course Title: Industrial Management and Entrepreneurship	Course Code: 18M501C
Semester: V	Course Group: Core
Teaching Scheme in Periods (L:T:P): 45:15:0	Credits: 3
Methodology: Lecture +Tutorials	Total contact periods: 60
CIE: 60 Marks	SEE: 40 Marks

This course is common for DCHE & DPT

Prerequisites: Knowledge of Basic Sciences

COURSE OUTCOMES

	At the end of the course the students will have the ability to:
1	Explain the principles and functions of management and Outline Organization structure& organizational behavior
2	Describe the Functions of Production Management
3	Analyse the functions of Materials Management.
4	Estimate Marketing, sales & Feasibility study.

5	Make use of ISO 9000 & T.Q.M
6	Outline Industrial legislation & safety and role of entrepreneur and entrepreneurial development

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Periods	Questions to be set for SEE (Q No)				Remarks	
			R		U	A		
1	Principles and functions of management and organisation structure and behaviour	10	4	1		9(a)	13(a)	
2	Production management	10						
3	Materials management	10		2		10 (a)	14 (a)	
4	Marketing, sales & feasibility study	10						
5	Introduction to ISO 9000 & T.Q.M	10		3	5 ,6	9(b), 11(a), 11(b)	13(b), 15(a), 15(b)	

6	Industrial legislation & safety and Entrepreneurial development	10			7 ,8	10(b), 12(a), 12(b)	14(b), 16(a), 16(b)	
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Legend: R; Remembering, U: Understanding A: Applying

COURSE CONTENT

Industrial Management and entrepreneurship

Unit – 1

Duration: 10 Periods (L: 6.0 – T: 4.0)

Principles and functions of management and organisation structure and behaviour

Definitions of Industry, Commerce and Business. Evolution of management theories. Principles of Scientific Management, functions of management. Differences of administration and management. Role of industry, Types of ownership – Sole proprietorship, Partnership, Private limited, public limited company. Industrial Cooperatives, Philosophy, types of Organizations, Line and Staff and functional organisations. Advantages and limitations, departments in a large-scale industry. Effective organization. Motivation, different theories of motivation, leadership, styles.

Unit – 2

Duration: 10 Periods (L: 6.0 – T: 4.0)

Production management

Production, planning and control, relation with other departments, need for planning and its advantages, Routing, scheduling, dispatching, PERT and CPM, simple problems.

Unit – 3

Duration: 10 Periods (L: 6.0 – T: 4.0)

Materials management

Materials in industry, inventory control model, ABC Analysis, Safety stock, re-order level, Economic ordering quantity, Stores layout, stores equipment, Stores records, purchasing procedures, purchase records, Bin card, Cardex.

Unit – 4**Duration: 10 Periods (L: 6.0 – T: 4.0)****Marketing, sales & feasibility study**

Sellers and Buyers markets, Marketing, Sales, Market conditions, monopoly, oligopoly, perfect competition. Cost -Elements of Cost, Contribution, Break even analysis, Market Survey, Product and production Analysis, Materials input, Manpower, Location, Economic and Technical Evaluation, preparation of Feasibility study reports.

Unit – 5**Duration: 10 Periods (L: 6.0 – T: 4.0)****Introduction to ISO 9000 & T.Q.M**

Concept of quality, Definitions of the terms quality policy, quality management, quality systems, quality control and quality assurance. Elements of quality systems: Management responsibility, Quality system, contract review, design control, document control, purchasing, purchaser– supplied product, product identification and traceability, process control, Inspection and testing. Definition and Principles of quality assurance. Know the necessity of International standards –ISO- Evolution, Meaning, importance. Various standards under ISO. ISO 9000 series of standards- Features, series, Constituents, Advantages, Draw backs and beneficiaries (Whom does ISO 9000 help). 5-S principles-concept of zero defects. TQM-Meaning, Characteristics.

Unit – 6**Duration: 10 Periods (L: 6.0 – T: 4.0)****Industrial legislation & safety and Entrepreneurial development**

Employer – Employee relations, Trade, Union Settlement of disputes, collective bargaining, Welfare activities. Total Welfare concept, rights and responsibilities and Employers and employees. Salient features of Indian Factories Act, Importance of Safety at work places, Hazards, causes of accidents. Entrepreneur and entrepreneurship - Concept, definition, role, expectation. Entrepreneurship Vs Management, promotion of S.S.I. Self –employment schemes. Product selection, site selection, Institutional support needed, financial assistance programmes.

REFERENCE BOOKS

1. Industrial engineering and management by O.P Khanna
2. Production management by Buffa
3. Engineering Economics and management science by Banga & Sharma
4. Personnel management by Flippo
5. Entrepreneurship by NITTTR Chennai

SUGGESTED LEARNING OUTCOMES

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

Principles and functions of management and organisation structure and behaviour

- Define industry, commerce (Trade) and business.
- Know the need for management.
- Understand the evolution of management
- Explain the principles of scientific management.
- Understand functions of Management.
- Differentiate between management and administration.
- Understand types of ownerships
- Differentiate types of ownerships.
- Understand salient features of joint stock companies.
- Understand the philosophy and need of organization structure of an industry.
- Understand the line, staff and Functional organisations.
- List the advantages and limitations of line, staff and functional organizations.
- List different departments in a largescale industry.
- Explain the factors of effective organization.
- Understand organizational behaviour.
- Conduct for analysis.
- State motivation theories.
- State Maslow 's Hierarchy of needs.
- List out different leadership models.
- Explain the trait theory and behaviour theory of leadership.

Production management

- Differentiate and integrate production, planning and control.
- Relate the production department with other departments.
- State the need for planning and its advantages.
- Explain the stages of Production, planning and control.
- Explain routing methods.
- Explain scheduling methods.
- Explain dispatching.
- Draw PERT/CPM networks.
- Identify the critical path

Materials management

- Explain the role of the materials in Industry.
- Derive expression for inventory control.
- Explain ABC analysis.
- Define safety stock.
- Define reorder level.
- Derive an expression for economic ordering quantity.

- Explain stock layout.
- List out stores records.
- Explain the Bin card.
- Describe Cardex method.
- Explain purchasing procedures.
- List out purchase records.
- Describe the stores equipment

Marketing, sales & feasibility study

- Explain marketing functions.
- Explain Sales function.
- List out market conditions.
- Differentiate Sellers and Buyers 'market.
- Differentiate monopoly, oligarchy, and perfect competition.
- Conduct market and demand surveys.
- Differentiate product and production analysis.
- Identify the input materials, i.e. Bill of materials
- Explain the concept of cost.
- List out the elements of cost.
- Explain break-even analysis.
- Decide the location.
- Evaluate Economic and Technical factors.
- Preparation of feasibility study.
- List out different products currently in demand with market or industry.

Introduction to ISO 9000 & T.Q.M

- Understand the concept of quality.
- Know the quality systems and elements of quality systems.
- Know the principles of quality Assurance.
- Know the evolution of ISO standards.
- Discuss ISO standards and ISO 9000 series of quality systems.
- State the constituents of ISO 9000 series of standards for quality systems.
- State the outstanding features and drawbacks of ISO 9000 series of standards.
- List the beneficiaries of ISO 9000.
- Understand 5-S principles and ZERO DEFECT
- Know TQM concept and characteristics.

Industrial legislation & safety and Entrepreneurial development

- Describe employer and employee relations.
- Describe the mechanics of Trade Unions.
- Describe mechanics of settlement of in outs.
- Explain the significance of collective bargain.
- List out Welfare activities.
- Explain the total welfare concept.
- List out the rights and responsibilities of employees and employers.
- List out the salient features of Indian Factories Act.

- Explain the importance of safety at Work place.
- List out the important provisions related to safety.
- Explain hazard and accident.
- Explain the causes of accidents.
- Outline the concepts of Entrepreneurship.
- Define the word entrepreneur.
- Determine the role of Entrepreneurship.
- Describe the profile of an entrepreneur.
- Explain the requirements of an entrepreneur.
- Outline the expectations of Entrepreneurship.
- Determine the role of entrepreneurs in promoting Small Scale Industries.
- Describe the details of self-employment schemes.
- Explain the method of product selection.
- Explain the method of site selection.
- List the financial assistance programmes.
- List out the organisations that help an entrepreneur.

SUGGESTED E RESOURCES/STUDENT ACTIVITIES

1. www.learnengineering.com
2. www.nptel.ac.in
3. www.onlinestudies.com
4. www.classcentral.com
5. Prepare an organisational structure of institution
6. A Case study on principles of management.
7. Make a survey on marketing a product.
8. Prepare a list of ISO 9000 series as well as latest quality standards
9. Prepare sign boards representing safety measures.
10. Role play as an entrepreneur
11. Explore six sigma concepts.

CO-PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	Mapping Pos
18M501C.1	-	-	-	2	-	3	3	3	2	-	4,6,7,8,9
18M501C.2	1	2	2	1	-	3	1	1	1	2	1,2,3,4,6,7,8,9,10
18M501C.3	1	2	2	1	-	3	1	1	1	2	1,2,3,4,6,7,8,9,10
18M501C.4	2	2	2	1		3	1	1	1	2	1,2,3,4,6,7,8,9,10
18M501C.5	-	-	-	2	1	3	2	2	3	2	4,5,6,7,8,9,10

18M501C.6	-	-	-	2	2	3	2	2	3	-	4,5,6,7,8,9

QUESTION PAPER BLUE PRINT FOR CIE (MID I)

Unit No	Unit Name	Questions to be set for CIE (Q No)			Remarks
		R	U	A	
1	Principles and functions of management and organisation structure and behaviour	1 2	5(a) 5(b)	7(a) 7(b)	
2	Production management	3 4	6(a) 6(b)	8(a) 8(b)	

QUESTION PAPER BLUE PRINT FOR CIE (MID II)

Unit No	Unit Name	Questions to be set for CIE (Q No)			Remarks
		R	U	A	
3	Materials Management	1 2	5(a) 5(b)	7(a) 7(b)	
4	Marketing, Sales & Feasibility study	3 4	6(a) 6(b)	8(a) 8(b)	

BOARD DIPLOMA EXANIMATIONS, (C18)

C18-Semester End Examination (SEE)

Model Paper- 18M501C

INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP

TIME : 2 Hours

Max. Marks: 40

PART – A

Marks: 8 X 1 M = 8M

*NOTE : 1) Answer **all** questions and each question carries **one** mark.*

*2) Answers should be brief and straight to the point and shall not exceeding **three** simple sentences*

1. What does CPM stand for?
2. Write the formula to calculate EOQ?
3. Define trade.
4. What is ISO?
5. Define quality
6. What are zero defects?
7. In which year, Indian factories act formed?
8. List any two safety measure to be followed in hospitals.

PART – B

*Answer **all** questions . Each question carries **three** marks*

4x 3 M = 12M

9(a) What is Commerce and business?

OR

9(b) Write any three limitations of ISO 9000 series?

10(a) List any three marketing conditions.

OR

10(b) What are the causes of accidents?

11(a) Give any three beneficiaries of ISO.

OR

11(b) What does quality assurance mean?

12(a) What is Collective bargaining?

OR

12(b) Name any three Indian entrepreneurs in the field of steel manufacturing.

PART – C

*Answer **all** questions . Each question carries **five** marks*

4x 5 M = 20 M

13(a) Differentiate between Sole proprietorship and partnership.

OR

13 (b) Elaborate the components of quality system.

14 (a) Explain ABC analysis.

.

OR

14 (b) Compare and contrast Management and entrepreneurship.

15(a) State the constituents of ISO 9000 series.

OR

15(b) Explain 5S principles in detail.

16 (a) What are the qualities of an entrepreneur?

OR

16 (b) Explain Mechanical hazards in detail.

BOARD DIPLOMA EXANIMATIONS, (C18)
Model Paper- 18M501C
INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP
Mid -I (CIE)

Time : 1 Hour

Total Marks : 20 M

PART – A

Marks: 4 X 1M = 4 M

*NOTE: 1) Answer **all** questions and each question carries **one** mark.*

*2) Answers should be brief and straight to the point and shall not exceed **three** simple sentences*

1. Define commerce.
2. Write any two qualities of a leader.
3. What do you mean by production?
4. What does PERT stand for?

PART – B

Marks : 2 X 3M= 6 M

*NOTE: 1) Answer **all** questions and each question carries **three** marks*

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

5(a) What is management?

OR

5(b) List out theories of motivation.

6(a) State the advantages of planning.

OR

6(b) What is dispatching?

PART – C

Marks : 2 X 5 M = 10 M

NOTE :

1. Answer **all** questions and each question carries **five** marks.

2. The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer

7(a) What are the functions of management?

OR

7 (b) Draw a neat sketch of line and staff organization.

8 (a) Differentiate between PERT and CPM.

OR

8 (b) A Project has nine activities. The duration of each activity is as follows.

Sno	1	2	3	4	5	6	7	8	9
Activity	1-2	1-3	2-4	3-4	4-6	5-6	3-5	5-7	6-7
Duration(days)	6	8	7	12	3	5	7	11	10

Draw the network and find the project duration.

Board Diploma Examinations, (C18)
Model Paper- 18M501C
INDUSTRIAL MANAGEMENT AND ENTREPRENEURSHIP
Mid –II (CIE)

Time: 1 hr

Total Marks : 20

PART – A

Marks: 4 X 1 M = 4 M

*NOTE: 1) Answer **all** questions and each question carries **one** marks.*

*2) Answers should be brief and straight to the point and shall not exceed **three** simple sentences*

1. What does EOQ stands for?
2. Give the formula to calculate Contribution.
3. Define Market.
4. List any two elements of cost.

PART – B

Marks : 2 X 3 M= 6 M

*NOTE: 1) Answer **all** questions and each question carries **three** marks*

2) *The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.*

5(a) What is Reorder level?

OR

5(b) Draw a neat sketch of ABC analysis graph.

6(a) Mention any three differences between Sellers's market and Buyer's market.

OR

6 (b) Write a short notes on Monopoly?

PART – C

Marks : 2 X 05 M= 10 M

NOTE :

1) Answer **all** questions and each question carries **five** marks

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

7(a) Describe any two stores equipment.

OR

7 (b) Explain purchasing procedure.

8 (a) Differentiate product and product analysis.

OR

8(b) How to Prepare a feasibility study report.

Department of Technical education
State Board of Technical education & Training (TS)
DESIGN OF MACHINE ELEMENTS

Course title:	DESIGN OF MACHINE ELEMENTS			Course Code:		18M502C
				Course group:		Core
Semester:	V			Credits:		3
Teaching scheme in periods (L:T:P):		45:15:0		Total contact periods :		60
Methodology: Lecturer+ Assignment:						
CIE:	60 Marks			SEE:		40 Marks

Prerequisites: Basic knowledge of strength of materials

COURSE OUTCOMES

	At the end of the course the student should be able to
CO1	Describe the design procedure, Determine the size of screwed fastener for given application
CO2	Design shafts, keys and couplings under different loading conditions
CO3	Perform the design of belts , gear drives for a given application
CO4	Design sliding contact bearings and describe rolling contact bearings
CO5	Construct the cam profiles

Course Content and Blue Print of Marks for SEE

Unit No	Unit Name	Periods	Questions to be set for SEE (QN o)			
			R		U	A
1	A) Introduction to design B) Bolts Nuts,Screws	10	4	1	9(a)	13(a)
2	Shafts	10				
3	Keys, Couplings	10		2	10(a)	14(a)
4	Belts and gear drives	10				
5	Bearings	10		3	5,6	9(b),11(a), 11(b)
						13(b),15(a), 15(b)

6	Cams	10			7,8	10(b),12(a),12(b)	14(b),16(a), 16(b)	
Total		60	8			8	8	

LEGEND	REMEMBERING - R
	UNDERSTANDING-U
	APPLICATION-A

COURSE CONTENT

Duration: 10 Periods (L: 6.0 – T: 4.0)

1.A Introduction

Design philosophy, Factors governing the design of machine element
Design procedure: General sequence of steps in designing a machine element.
Need of standard data for design purpose, use of machine design data, hand books and other data manuals.

1.B Bolts, Nuts & Screws

Screw nomenclature, specifications.
Types of screw fasteners
Strength of screwed fasteners and failure due to different reasons
Stresses due to initial tightening and external forces
Stress due to combination of forces
Design of a Nut – Hexagonal and square nuts only.
Design and draw an Eye bolt for a given load and using empirical proportions,
Applications of eye-bolt and Numerical problems

2. Shafts

Duration: 10 Periods (L: 6.0 – T: 4.0)

Functions, Materials, Types
Standard sizes of shafts as per I.S
Design of diameters for solid and hollow shafts to transmit a given power at given rpm.,
a) Based on strength
b) Based on rigidity.
Comparison of solid and hollow shafts, Design of axle, Numerical problems.

3. Keys and Couplings

Duration: 10 Periods (L: 6.0 – T: 4.0)

keys

Function of keys, types of keys,
Splines, Specification of splines.

Materials of keys and splines. Key failure

Effect of key way on the shaft strength.

Design of a rectangular sunk key considering its failure against shear and crushing and using empirical proportions for given diameter of the shaft. Proportions of a spline for a given application using tables.

Couplings

Function, types of couplings.

Design and draw a muff coupling (solid) and rigid flange coupling for a given torque using empirical formulae.

3. Belts and Gear Drives

Duration: 10 Periods (L: 6.0 – T: 4.0)

Factors to be considered while selecting the type of drive -Belt drive, types of belt drives; belt materials, belt joints- length of open and crossed belts (without proof). Slip and Creep-Expression for the ratio of belt tensions (without proof), Concept of centrifugal tension – Relation between centrifugal tension and the tension on tight side for transmitting maximum power (derivation omitted) - Permissible stress in the belt per unit width, per unit cross section-Calculation of belt thickness and width for given permissible stress for open and crossed belts, considering centrifugal tension and without considering centrifugal tension.

Gear tooth terminology–Involute and Cycloidal profiles- advantages of involute profile-Gear Material-Simple, compound, reverted & Epi-cyclic gear trains-simple problems on gear terminology- number of teeth for simple, compound and reverted gear trains for a given speed ratio.

5. Bearings

Duration: 10 Periods (L: 6.0 – T: 4.0)

Functions, types of bearings, lubrication types, Journal bearing – terminology, performance - McKee's Equation, Bearing Modulus, power lost in friction and heat generated.

Thrust bearing- Power lost in friction, flat pivot and flat collar under conditions of uniform intensity of pressure and wear.

Rolling contact bearings – advantages and disadvantages-Components of rolling contact bearing, ball and roller bearings-Rating life of antifriction bearing, Static load carrying capacity, dynamic load carrying capacity, equivalent radial load - Load-Life relationship (without derivations),

Market or commercial specifications of ball and roller bearings as per BIS standards

6. Cams

Duration: 10 Periods (L: 6.0 – T: 4.0)

Functions of cam - Classification of cams and followers – uses. Working principle of plate and cylindrical cams - Nomenclature of cam profile, base-circle, cam angles, trace point - Motion of follower – Uniform velocity, uniform acceleration and retardation and simple harmonic motion – Time vs. Displacement diagram only - Construction of cam profile of a plate cam with knife edged, flat & roller follower for all three types of motions stated above - Problems on drawing of cam profiles as stated above for the follower axis passes through the axis of the cam shaft (offset followers not included)

REFERENCES

1. Machine Design - Shiegley.
2. Machine Design - R.S.Khurmi.
3. Design of Machine Elements - Pandya and Shah.
4. Theory of machines- Thomas Bevan.
5. Design of Machine Elements – V B Bhandari [Tata Mc Graw Hill]

SUGGESTED LEARNING OUT COMES

Understand the concept of mechanical engineering design and the design of Bolts and Nuts

- Explain the basic requirements of design.
- Explain the phases of design process
- List the factors governing the design.
- Use relevant Indian Standard Codes.
- Explain screw thread nomenclature and specifications of screw threads
- List the different threaded fasteners with legible sketches.
- Explain the strength of screwed fasteners
- List the stresses in bolts
- Design the size of bolt for a given load
- Design a Hexagonal and a Square Nut
- Design the size of eye bolt for a given load.
- Draw an eye bolt showing the proportions.

Understand the design of Shafts

- Define the terms shaft and axle
- State the functions of shaft
- List the types of shafts
- List the standard sizes of shafts as per I.S
- Write the formula for power transmitted by the shaft
- Design the shaft subjected to only torsion
- Design the shaft subjected to only bending load (Design of axle)

- Design the shaft subjected to bending and torsion based on Rankine and Guest theories
- Design the shaft against the rigidity.
- Compare the strength and rigidity of solid and hollow shafts

Understand the design of Keys and Couplings

- Explain the types and function of keys and splines.
- Name the recommended materials used for keys and splines.
- Design the keys based on different modes of failure and also based on empirical relations
- Write all the proportions of a spline for a given application referring tables.
- Write the specifications of parallel, gib-head and taper sunk keys as per B.I.S.
- Explain the function of a coupling
- Classify the couplings
- Design the muff coupling for a shaft of given Torque and using empirical relations.
- Design the cast iron flange-coupling (rigid type) for a given torque
- Draw the above couplings according to the standard specifications

Understand the Design of Belts and gear drives

- List the different power drives.
- Compare the flexible drives with the rigid drives
- Classify the belt drives
- List the belt materials
- Define the slip and creep in belts.
- Explain the effect of slip and creep on power transmission
- Write the expression for the length of open and cross belts
- Write the expression for ratio of belt tensions
- Write the expression for centrifugal tension in the belt
- Explain the effect of centrifugal tension on power transmission
- Design the belt cross-sectional dimensions (V-belts are excluded)
- Solve the numerical problems related to the above cases.
- Explain the nomenclature of spur gear tooth.
- Identify various tooth profiles of gear.
- Advantages of involute profile
- Explain the terminology related to gear drive
- List the gear material
- List different types of gear trains
- List all the advantages and disadvantages of gear drives.
- Explain different types of gear trains
- Solve the simple problems related to gear terminology and gear trains.

Understand the design of Bearings

- State the function of bearing.

- Classify the bearings–sliding and rolling contact.
- State the advantages and disadvantages of sliding contact bearings
- List the types of lubrication.
- Explain the construction and working principle of journal bearing
- Explain friction in journal bearing and give McKee's equation.
- Explain the terms in McKee's equation.
- Design a simple journal bearing.
- Calculate heat generated and dissipated in journal bearing
- Write the expressions for the load and torque carried by thrust and collar bearings under uniform pressure and wear conditions (without proof)
- Calculate heat generated and dissipated in collar bearing based on uniform pressure and uniform wear conditions
- Solve the numerical problems.
- Explain the nomenclature of rolling contact bearing.
- Explain the types of ball and roller bearings
- List the Advantages and disadvantages of anti-friction bearings
- List all the differences between sliding contact and roller bearings
- Properties of the bearing material
- Define the terms- Rating life, Basic load rating and equivalent radial load
- Give the load – life relation for rolling contact bearings (problems omitted)
- Specify a bearing

Understand the Design of Cams

- Explain the function of cam
- Classify the cams.
- Explain the cam profile.
- Define terms related to cam profile.
- Draw angular - displacement diagram for lift motion for:
 - a) Uniform velocity.
 - b) S.H.M.
 - c) Uniform acceleration & retardation.
- Draw simple cam profiles in above three cases for knife edged, flat and roller followers. (Offset followers are omitted)

Suggested E-resources and student Activities

1. <https://acdemicearth.org>

2. <https://onlinecourses.nptel.ac.in>

3. Student inspects the available equipment in the lab to identify different machines.

4. Identify the purpose of Gear trains used in automobiles, machine tools etc.

5. Draw the Involute and Cycloidal Gear tooth profile.

6. Quiz

7.Group discussion

8.Surprise test

CO-PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	Mapping Pos
1	3	3	1						1		1,2,3,9
2	3	3	1						1		1,2,3,9
3	3	3	1						1		1,2,3,9
4	3	3							1		1,2,9
5	3	3	1						1		1,2,3,9
6	3	3	1						1		1,2,3,9

Course Content and Blue Print of Marks for MID - I

SL.NO	UNIT NAME	R	U	A	REMARKS
1	Introduction, Bolts, Nuts, Screws	1,2	5(a) 5(b)	7(a) 7(b)	
2	Shafts	3,4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

Course Content and Blue Print of Marks for MID - II

SL.NO	UNIT NAME	R	U	A	REMARKS
1	Keys, Couplings	1,2	5(a) 5(b)	7(a) 7(b)	
2	Belts and gear drives	3,4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

C18-MID 1 Examination

Model Paper-

18M-502C DESIGN OF MACHINE ELEMENTS

TIME : 1 Hour

Max. Marks: 20

PART – A

Marks: 04 X 1 M = 4M

NOTE:1) Answer **All** questions and each question carries one mark.

2) Answers should be brief and straight to the point

1. List out the governing factors to be considered while designing a machine element.
2. Write the meaning of M20X1.5
3. State the function of an axle.
4. List out the materials used for shafts.

PART – B

Answer all questions

2 x 3 M = 6M

5(a). What size of a hole must be drilled in M50 bolt to make it uniform strength.

OR

5(b) Compute the safe tensile load for a bolt of M20 if the safe tensile stress is 80 N/mm^2

6(a) A solid shaft is required to transmit a torque is 15 kN-m. Find the diameter of the shaft, if the tensile stress is 60 N/mm^2

(OR)

6(b). A hollow shaft is used to transmit a torque of 10 kN-m, having an inner diameter 20mm and outer diameter of 40mm, what is the maximum shear stress induced in the shaft material.

PART – C

Answer all questions

2 x 05 = 10M

7(a). An electric machine weighing 25 kN is provided with a steel eye bolt for lifting. If the Ultimate tensile strength of steel is 480 N/mm^2 and the factor of safety is 6. Find the size of bolt,

(OR)

7(b). A steam engine cylinder of 250 mm effective diameter is subjected to a steam pressure of 1.2 N/mm^2 . The cylinder cover is connected by means of 6 bolts. The bolts are tightened with initial load of 1.5 times that of steam load. A copper gasket of stiffness factor 0.5 is used to make the joint leak proof. Find the size of the bolts so that the stress induced in the bolts is not to exceed 100 N/mm^2 .

8(a) A steel spindle transmits 10kW at 800 rpm. The angular deflection should not exceed 0.25° per meter length of spindle. If the modulus of rigidity for the material of spindle is 84103 N/mm^2 , find the diameter of the spindle.

(OR)

8(b) A hollow shaft transmits a power of 50 kW at 150 rpm. The shear stress induced in the shaft material is 55 MPa. The inside diameter is to be 0.6 of the outside diameter, Find the inside and outside diameter.

C18-MID Sem-2 Examination

Model Paper-

18M-502C DESIGN OF MACHINE ELEMENTS

TIME : 1 Hour

Max. Marks: 20

PART – A

Marks: 04 X1 M = 04M

NOTE : 1) Answer **All** questions and each question carries one mark.

2) Answers should be brief and straight to the point

1. State the functions of key.
2. State the functions of coupling.
3. List the types of belts
4. Define circular pitch.

PART – B

Answer all questions

2 x 3 M = 06M

5(a) Draw the neat sketches of any three keys.

(OR)

5(b) What shear stress is induced in a square key of 12 mm wide and 75 mm long, placed in a 50 mm diameter shaft if 15 kW power transmitted at 200 rpm.

6(a) Draw a neat sketch of open belt drive

(OR)

6(b) A wheel has 48 teeth and a circular pitch of 24 mm Find pitch circle diameter.

PART – C

Answer all questions

2 x 5 = 10M

7 (a) Design a cast iron muff coupling using the following data

Mild steel shaft transmits 80 kW at 150 rpm, allowable shear and crushing stresses are 40 N/mm^2 and 100 N/mm^2 , the permissible shear stress in the muff is 15 N/mm^2 . Assume maximum torque is 25% greater than mean torque.

(OR)

7(b) Design a shaft and bolts for cast iron flange coupling to connect two shafts in order to transmit 9 kW at 800 rpm. The permissible shear and crushing stress for shaft and bolt material are 35 N/mm^2 and 60 N/mm^2 .

8 (a) Find the length of an open belt drive for the two pulleys having diameters as 0.4 m and 0.6 m and distance between two pulleys are 4m.

(OR)

8 (b) Explain about simple gear train with neat sketch

BOARD DIPLOMA EXAMINATION

C18-end semester Examination

Model Paper-

18M-502C DESIGN OF MACHINE ELEMENTS

TIME : 2 Hrs

Max. Marks: 40

PART – A

Marks: 08 X1 M = 08M

*NOTE : 1) Answer **All** questions and each question carries one marks.*

*2) Answers should be brief and straight to the point and shall not exceed **three** simple sentences*

1. How a screw thread is designated.
- 2.. Write the advantages of chain drives over belt drive.
3. Define Lift
4. State the function of the shaft.
5. Define bearing
6. write the applications of bearings.
7. Draw a neat sketch of cam mechanism
8. Name the types of followers

PART – B

Answer all questions

4 x 3 M = 12M

9(a) List out the six factors which governs the design of machine part.

(OR)

9(b) Write the classification of bearings

10(a) Define circular pitch and module (OR)

10(b) explain about cam mechanism.

11(a) write the advantages of rolling contact bearings over sliding contact bearings (OR)

11(b) The load on a journal bearing is 150 kn due to turbine shaft of 300 mm diameter running at 1800 rpm. Determine length of bearing if the bearing pressure is 1.6 N/mm²

12(a) Define the following

(i) Dwell, (ii) base circle (iii) cam profile

12(b) Draw any three cam followers.

PART-C

4X5=20

13(a) The cap of a connecting rod end is screwed by toe bolts. If the maximum pull in the connecting rod

is 60 kN. Find the diameter of the bolts, if the stress is not exceeded is 30 N/mm^2 .

(OR)

13(b) A journal bearing whose diameter is 200mm is subjected to a load of 50 kN, and the shaft makes 100 rpm. Find the heat generated by friction, if coefficient of friction is 0.02

14(a) Find the length of an open belt and crossed belt, driving two parallel shaft 4m apart connected by

two pulleys having diameters 0.4 m and 0.6m.

(OR)

14(b) Explain the construction of displacement diagram for a follower moving with SHM.

15(a) A flat foot step bearing 300 mm diameter supports a load of 25 kN. If the coefficient of friction is

0.05 and speed 150 rpm ,calculate the power lost at the bearing.

(OR)

15(b)An axial thrust on a flat pivot bearing is 30 kN ,the coefficient of friction is 0.05 and the diameter of the bearing is 250 mm, find the frictional torque, assume uniform pressure.

16(a) Draw the cam profile for a knife edge follower with SHM whose out stroke is with maximum displacement of 180 mm during 180° of cam rotation, return stroke is for 150° , and dwell during remaining is 30° , the axis of the follower passes through the cam shaft axis, the minimum radius of the cam is 25 mm.

(OR)

16 (b) Draw the cam profile for a flat follower with uniform velocity whose out stroke is with maximum displacement of 180 mm during 180° of cam rotation, return stroke is for 150° , and dwell during remaining is 30° , the axis of the follower passes through the cam shaft axis, the minimum radius of the cam is 30 mm.

CAD / CAM

Course Title : CAD/CAM	Course Code : 18M503C
Semester : V SEM	Course Group : CORE
Teaching Scheme in Periods (L:T:P) : 45:15:0	Credits : 3
Methodology : Lecture + Tutorials	Total Contact PERIODS : 60 periods
CIE : 60 Marks	SEE : 40 Marks

Prerequisites: Basic knowledge of Computers.

COURSE OUTCOMES

	At the end of the course the students will be able to :
1	Define computer aided Design (CAD)
2	Define Computer aided Manufacturing systems (CAM)
3	Illustrate Numeric Control Machines
4	Illustrate CNC machines and their Components.
5	Apply codes and Prepare CNC part programming.
6	Illustrate CIMS, FMS and Robots, Explain and identify Applications

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Periods	Questions to be set for SEE(Q No)				Remarks
			R		U	A	
1	Computer Aided Design	10	4	1	9(a)	13(a)	
2	Computer Aided Manufacturing	10					
3	Introduction to Numeric control Machines	10		2	10(a)	14 (a)	
4	CNC Machines & their Components	10					
5	CNC Part Programming	10		3	5, 6	9(b), 11(a), 11(b)	13(b), 15(a), 15(b)
6	CIMS, Flexible Manufacturing Systems & Robotics	10					

Legend: R; Remembering, U: Understanding A: Applying

COURSE CONTENTS

UNIT-I

Duration: 10 Periods (L: 6.0 – T: 4.0)

1.COMPUTER AIDED DESIGN AND MANUFACTURING

Introduction to CAD- Benefits of CAD-Stages of CAD-CAD input devices- CAD Output devices- CAD display devices-Types of CAD systems-Types of CAD soft ware-Features of different CAD software- Computer communications-Types of computer communications networks

UNIT-II

Duration: 10 Periods (L: 6.0 – T: 4.0)

2. COMPUTER AIDED MANUFACTURING

Introduction to CAM- Functions of CAM-Benefits of CAM- CAPP - Integrated CAD / CAM Organization – concept- Necessity of CAD/CAM integration- Computer integrated production system – features-Computer integrated production system –advantages- Concept and advantages of MRP I and MRP-II – Introduction to ERP and SAP

UNIT-III

Duration: 10 Periods (L: 6.0 – T: 4.0)

3.INTRODUCTION TO NUMERIC CONTROL MACHINES

Introduction to numerical control-Features of NC system-Advantages of NC system-Limitations of NC system in comparison to conventional systems-Layout of NC system-Functions of each component of NC system – Classification of NC – motion control in NC system - Manufacturing methodology on NC system-Development of CNC and DNC systems comparative treatment of features for NC, CNC, DNC - Block diagram of CNC system Functions of each component of a CNC system-Working principle of CNC system – Specifications of CNC machines - advantages of CNC over NC systems

UNIT-IV

Duration: 10 Periods (L: 6.0 – T: 4.0)

4.CNC MACHINES AND THEIR COMPONENTS

Machining centres –Types- Construction features of machining centres – specification of MC - Automatic tool changer, working of Tool gripper and tool magazine- types of tool magazines - Automatic pallet changer - Care and maintenance of CNC machines-Spindle drives – feed drives - Slide ways – types with illustrations- Bearings – linear motion bearings – recirculatory ball screws- Feedback devices transducers - encoders – linear transducers.

UNIT-V Duration: 10 Periods (L: 6.0 – T: 4.0)

5. CNC PART PROGRAMMING

Steps involved in CNC part programming-CNC coordinate system- Machine zero – work zero- interpolation – types - Co-ordinates referencing methods-Preparatory functions (G codes)- Miscellaneous functions (M codes)- structure of part programming - Manual part programming –format- APT programming -coding- canned cycles - Macros-subroutines-Thread cutting cycles-Taper turning cycles-Peck drilling cycles-Programming Practice problems on Plain turning- Step turning-Taper turning and thread cutting.

UNIT-VI Duration: 10 Periods (L: 6.0 – T: 4.0)

6. CIMS, FLEXIBLE MANUFACTURING SYSTEMS & ROBOTICS

Computer integrated manufacturing system – features-Necessity of CIMS, Flexible manufacturing system – features- Necessity of FMS-Components of FMS –illustration-Functions of each component-Advantages and limitations of FMS-Automatic guided vehicles and different types- Automatic storage and retrieval system - Computer aided inspection Introduction to CNC CMM – features working and Advantages of CNC-CMM-Definition of robot – classification – features – necessity-Components of robot – illustration – functions of each component- Manipulator – illustration – degrees of freedom-End effectors - types with illustration – necessity and application-Industrial application of robots – advantages and limitations

REFERENCE BOOKS:

Computer Integrated Design and Manufacturing, McGraw Hill – Bedworth David. D
Computer Integrated Manufacturing, PHI – Paul G. Ranky
Industrial Robotics, PHI – Gordon. N. Mair
Numerical Control And Computer Aided Manufacturing, TMH – T. K. Kundra, P.N. Rao
Computer Aided Manufacturing, TMH – T. K. Kundra, P.N. Rao
CNC Machines, New Age – B.S. Pabla and M. Adithan
CAD, CAM, CIM ----- BY Radha Krishnan.

SUGGESTED LEARNING OUTCOMES

On completion of the course the student should be able to

Computer Aided Design

- Define CAD
- Identify advantages of CAD
- Identify CAD software and hardware
- Illustrate various CAD Input and Output devices
- Appreciate importance of Auto CAD as a CAD software

- Familiarize with Graphic Work Station.
- Familiarise networking of computers
- Stages of CAD
- CAD Display devices
- Types of CAD Systems

Computer Aided Manufacturing

- Define CAM
- Identify the functions of CAM
- Appreciate the advantages of CAM
- Functions of CAM
- Stages of CAM
- Computer aided process planning
- Familiarize with the term computer integrated production system
- Familiarize with the terms material requirement planning (MRP I) and manufacturing resources planning (MRP II) and advantages
- Draw block diagram of MRPI
- Introduction to ERP and SAP
- Need of CAD/CAM Integration

Introduction to Numeric Control machines

- Define numerical control
- Identify the components of NC & CNC system
- Classification of NC ,Open and closed system NC
- Motion control system of NC Point to point, continuous and contouring.
- Differentiate between NC, CNC & DNC systems
- Manufacturing Methodology of NC system
- Illustrate the working principle of CNC system
- Illustrate the working principle and advantages of DNC system
- Specifications of NC/CNC

CNC Machines and their Components

- Familiarize with the term Machining Centre.
- Identify the maintenance aspects of CNC machines
- Appreciate the role of CNC in computer integrated manufacturing environment
- Identify the various spindle drives
- Appreciate the accuracy of Stepper and Servo motor
- Illustrate slide ways
- Familiarize with linear motion bearings, recirculatory ball screws
- Appreciate the importance of automatic tool changer and its components.
- Illustrate tool gripper and tool magazine
- Identify the various feedback devices.
- Specification of Machining centre

- Constructional features of Machining centres
- Features of Automatic pallet changer
- Working of linear and rotary transducer

CNC PART PROGRAMMING

- Familiarize with structure of NC part program
- Differentiate between manual and computer aided programming methods
- Familiarize with G & M codes
- Know the method of programming tool information, feed, speed data
- Interpolation and types linear, circular and parabolic.
- Write a part program in G & M codes.
- Write part program for Facing, plain turning, taper turning and step turning
- Identify the various programming cycles like simple turning cycle, peck drilling cycle, Grooving cycle, Boring cycle and thread cutting cycle.
- Appreciate the importance of macros, sub routines, canned cycles.
- Familiarize with APT programming
- CNC Coordinate system

CIMS,FMS&ROBOTICS

- Define CIMS
- Appreciate the necessity of CIMS
- Appreciate the advantages of CIMS
- Identify FMS as a sub set of CIMS
- Identify the components of FMS AGV's and ASRS
- Illustrate the working of FMS
- Identify the benefits of FMS
- Appreciate the importance of coordinate measuring machine.
- Illustrate the main features of CNC-CMM
- Advantages of CNC-CMM
- Define a robot
- Classify robots
- Identify the various elements of a robot
- Illustrate the working of a manipulator
- Illustrate the types of end effectors
- Identify the applications of robots
- Appreciate the role of robots in CIMS
- Advantages and Limitations of Robotics

SUGGESTED E RESOURCES/STUDENT ACTIVITIES

- A Visit to a nearest Industry working on CNC Machines.
- Identify various machine tools including CNC and write the report differentiating an ordinary machine tool with CNC machine tool
- Write a part program for producing work pieces like round rods, stepper rods and screwed fasteners etc.
- www.nptel.ac.in
- www.coursera.com

CO-PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	Mapping Pos
1	1	3	-	-	3	1	2	2	2	-	1, 2, 5, 6, 7, 8, 9
2	1	3	-	-	3	1	2	2	2	-	1, 2, 5, 6, 7, 8, 9
3	3	3	-	-	3	3	3	2	3	2	1, 2, 5, 6, 7, 8, 9, 10
4	1	3	2	1	-	3	3	3	2	2	1, 2, 3, 4, 6, 7, 8, 9, 10
5	1	1	1	1	1	1	1	1	2	2	1, 2, 3, 4, 5, 6, 7, 8, 9, 10
6	2	2	1	-	3	2	2	1	2	2	1, 2, 3, 5, 6, 7, 8, 9, 10

QUESTION PAPER BLUE PRINT FOR CIE (MID I)

Unit No	Unit Name	Questions to be set for CIE (Q No)			Remarks
		R	U	A	
1	Computer Aided Design	1	5(a)	7(a)	
		2	5(b)	7(b)	
2	Computer Aided Manufacturing	3	6(a)	8(a)	
		4	6(b)	8(b)	

QUESTION PAPER BLUE PRINT FOR CIE (MID II)

Unit No	Unit Name	Questions to be set for CIE (Q No)			Remarks
		R	U	A	
3	Introduction to Numeric Control machines	1	5(a)	7(a)	
		2	5(b)	7(b)	
4	CNC machines & Their Components	3	6(a)	8(a)	
		4	6(b)	8(b)	

18M503C

BOARD DIPLOMA EXANIMATIONS, (C18)

Model Paper

CAD CAM

Mid Sem-I (CIE)

Time : 1 Hour

Total Marks : 20 M

PART – A

Marks: 4 X 1M = 4 M

NOTE: Answer **all** questions and each question carries **one** mark.

1. Define CAD
2. List out few Cursor Control Devices.
3. State any two functions of CAM
4. Define MRP.

PART – B

Marks : 2 X 3M = 6 M

NOTE: Answer **all** questions and each question carries **Three** marks

5(a) Write about the Various Output Devices.

Or

5(b) Write about Various types of LAN Networks.

6(a) Explain about the features of Computer Integrated production Systems.

Or

6(b) Explain about the features of material requirement planning (MRP-I).

PART – C

Marks : 2X 5M = 10 M

NOTE: Answer **all** questions and each question carries **Five** marks.

7(a) Explain in detail various stages involved in design in CAD with a neat sketch.

Or

7(b) Classify CAD software's and explain the merits and demerits of different CAD software's available in market.

8(a) Explain about Integration of CAD/CAM with a neat sketch

Or

8(b) Explain in detail about MRP-I & MRP-II.

Board Diploma Examinations, (C18)
Model Paper
CAD CAM
Mid Sem-II (CIE)

Time : 1 Hour

Total Marks : 20 M

PART – A

Marks: 4 X 1M = 4 M

*NOTE: Answer **all** questions and each question carries **one** mark.*

1. List the advantages of NC system over conventional systems
2. Define numerical control.
3. What is machining centre? What are its types
4. What is an Automatic tool changer

PART – B

Marks : 2 X 3M= 6 M

*NOTE: Answer **all** questions and each question carries **Three** marks*

5(a) Compare between NC and CNC systems.

Or

5(b) Draw the layout of DNC system and write short notes on it.

6(a) Write Short notes on Automatic Tool changer and Tool magazines.

Or

6(b) Write about the maintenance of CNC Machines.

PART – C

Marks : 2 X 5M = 10 M

*NOTE: Answer **all** questions and each question carries **Five** marks.*

7(a) Describe various types of spindle drives with neat sketches.

Or

7(b) Define numerical control and explain about the basic components of NC system

8(a) Explain about the re-circulating ball screw mechanism and state its advantages.

Or

8(b) Explain about various feedback devices.

18M503C

**BOARD DIPLOMA EXANIMATIONS, (C18)
SEMESTER END EXAMINATION(SEE)
CAD/CAM**

Time : 2 Hours

[Total Marks: 40]

PART-A

08X01=08

- Instructions :**
1. Answer **ALL** questions.
 2. Each question carries **ONE** mark.

1. Mention any three advantages of CAD.
2. Define numerical control. What are the basic components of NC system?
3. What is miscellaneous function? Give any two examples.
4. Write ant three functions of CAM.
5. List few preparatory functions
6. What is tool nose radius compensation?
7. What is a robot?
8. What is FMS?

PART-B

04X03=12

- Instructions :**
1. Answer any **FOUR** questions.
 2. Each question carries **THREE** marks.

9. (a) Explain various stages involved in design of a component using CAD.
(or)
9. (b) Write short notes on Canned cycles and Subroutines
10. (a) Describe various types of spindle drives.
(or)
10. (b) Explain the function of each component of a robot.
11. (a) Explain briefly about linear interpolation and circular interpolation.
(or)
11. (b) Write short notes on macros and mirror image.

12. (a) Explain about types of end effectors
(or)
12. (b) write short notes on CIMS

PART-C

04X5=20

- Instructions :**
1. Answer any **FOUR** questions.
 2. Each question carries **FIVE** marks.

13. (a) What is MRP-II? Explain in detail various functions of MRP-II.
(or)
13. (b) List various types of statements used in APT programming? Explain them in detail.
14. (a) Explain in detail the procedure involved in computer aided part programming.
(or)
14. (b) Describe the working of CMM with the help of a legible sketch.
15. (a) Differentiate between manual and computer aided part programming.
(or)
15. (b) Write a program on manual facing to reduce into 25mm dia 70 mm length rod into 25mm dia 68mm length.
16. (a) Explain about various types of FMS and their components
(or)
16. (b) Write the advantages, limitations and applications of robots.

INDUSTRIAL ENGINEERING

Course Title : Industrial Engineering	Course Code : 18M504E (A)
Semester : V	Course Group : Elective
Teaching Scheme in Periods (L:T:P:) : 45:15:0	Credits : 3
Methodology : Lecture +Tutorials	Total contact periods : 60
CIE : 60 Marks	SEE : 40 Marks

Prerequisites: Knowledge of Basic Sciences and Industrial Management

COURSE OUTCOMES

	At the end of the course the students will have the ability to:
1	Improve productivity using work-study and method study procedures.
2	Analyse work content and calculate standard time in a given situation.
3	Learn the procedures of job evaluation and compare various merit-rating methods.
4	Interpret different methods of wages and incentives payments.
5	Compare various inspection methods used in the industries.
6	Apply statistical control tools in a given situation.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Periods	Questions to be set for SEE(Q No)				Remarks	
			R		U	A		
1	Work study-Method study	10	4	1		9(a)	13(a)	
2	Work study-Work measurement	10						
3	Job evaluation and Merit rating	10		2		10 (a)	14 (a)	
4	Wage and incentive systems	10						
5	Inspection	10		3	5, 6	9(b), 11(a), 11(b)	13(b), 15(a), 15(b)	

6	Statistical quality control	10			7, 8	10(b), 12(a), 12(b)	14(b), 16(a), 16(b)	
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Legend: R; Remembering, U: Understanding A: Applying

COURSE CONTENT

Industrial Engineering

Unit – 1

Duration: 10 Periods (L: 6.0 – T: 4.0)

Work study-Method Study

Meaning and purpose- Components of Work study – Method study & Time study - Method study- purpose -procedure - Process chart symbols-types - Outline process chart -illustration - Flow process chart - illustration - Flow diagrams-illustration - String diagram -illustration - Two handed process chart-illustration - Micro motion study- concept - Principles of Motion economy - Therbligs - SIMO Chart - Cycle graph -Chronocyclegraph

Unit – 2

Duration: 10 Periods (L: 6.0 – T: 4.0)

Work study-Work measurement

Time study –Purpose-Stop watch study - Procedure - Performance rating –concept - Rating scales - Time allowances - Determination of Normal Time & standard time.- simple problems on Normal and standard times - PMTS-necessity - advantages - Work sampling-concept – advantages - Simple problems on Work sampling –Ergonomics.

Unit – 3

Duration: 10 Periods (L: 6.0 – T: 4.0)

Job Evaluation & Merit rating

Job evaluation – Definition-Objectives-Procedure –Job Analysis-Job description-Job specification-Methods of Job evaluation-Merit rating-Definition-Objectives-Methods-Advantages-disadvantages.

Unit – 4

Duration: 10 Periods (L: 6.0 – T: 4.0)

Wage and Incentive systems

Wages-Definition-types-wage differentials-Wage payments methods-Standard wage plans-types-simple problems on wage plans-Incentives-meaning-Types.

Unit – 5

Duration: 10 Periods (L: 6.0 – T: 4.0)

Inspection

Quality-quality of design-quality conformance-quality assurance - Quality & cost relationship- Inspection – objectives of inspection- Methods of inspection.

Unit – 6

Duration: 10 Periods (L: 6.0 – T: 4.0)

Statistical Quality Control

Quality control-necessity - variation in manufacture-assignable causes - chance causes - Quality characteristics-variables-attributes -Normal curve-properties of normal curve-Control charts – necessity - types – $\bar{X}$ bar(average mean) and R charts – concept -Method of constructing $\bar{X}$ bar (average mean)-R chart-simple problems. Control chart for attributes – advantages - Method of constructing – fraction defective and no. of defectives charts -simple problems - Terminology of sampling inspection -OC curve – illustration-importance -Single sampling plan – illustration - Double sampling plan - illustration - A B C standard plan – use of tables - Acceptance criteria for single and double sampling plans using tables.

REFERENCE BOOKS

1. Introduction to Work-study by ILO
2. Work study by Ralph & Barnes
3. Industrial Engineering & Management Science by TR Banga
4. SQC by Juran
5. SQC by Grant & Levenworth

SUGGESTED LEARNING OUTCOMES

Work study-Method Study

- Understand the work study techniques of industrial engineering
- Apply method study to a given situation.
- State the steps involved in method study.
- Identify the types of charts like outline process chart, flowchart, two-hand process chart, string diagram, flow diagram used in recording method study.
- Assemble the elements with symbols to form the required chart.
- State the question in their order to analyse the operational sequence.
- Analyse the question to form best sequence.
- Conclude the best sequence.
- Draw modified chart.
- Draw cycle graph and Chrono cycle graph.

- Define Micromotion study.
- Define Therbligs and list out all therbligs.
- Choose therblig symbols to represent micro motion study.
- Interpret the SIMO chart.
- Define Ergonomics

Work study-Work measurement

- State the purpose of work measurement.
- Describe the time study equipment.
- Describe the sequence of making Time study.
- State the rules for elemental breakdown.
- State the procedure of time recording.
- Explain the need for rating factor.
- Explain the importance of allowances.
- Compute the normal time and standard time for an operation using observed time.
- State the procedure, advantages and disadvantages of PMTS (Pre determined Motion Time Standards).
- State the procedure, advantages, disadvantages and applications of work sampling.

Job Evaluation & Merit rating

- Define job evaluation.
- State the purpose and procedure of job evaluation.
- Explain the job analysis, job description and jobs specification.
- Explain the methods of job evaluation a) Ranking Method b) Classification Method c) Factor comparison method d) Point rating method
- State the advantages and disadvantages of the above methods.
- Define the merit rating
- State the purpose of merit rating.
- Explain the methods of merit rating a) Rating scale method b) Check list method c) Employee comparison method.
- State the advantages and disadvantages of merit rating.

Wage and Incentive systems

- State the types of wages.
- Define the term base wage.
- Outline the standard wage plans such as Halsey, Rowan, Emerson, Taylor's differential piece rate system.
- Solve problems on above wage plans for calculating earnings.
- Define incentive.
- State types of incentives.
- Explain the incentives for supervisor and executives.

Inspection

- Define quality, quality assurance and quality of conformance.

- Distinguish between the terms quality of design and quality of manufacturing.
- Discuss quality-cost relationship.
- Discuss quality variation parameters.
- Explain inspection procedures.
- State the different inspection methods.
- Identify differences between various methods of inspection.
- State the advantages and limitations of the above methods.

Statistical Quality control

- Define quality control and statistical quality control.
- State the types of causes of variations –Assignable and Chance causes.
- State the characteristics of normal distribution.
- Outline control charts and use of the charts.
- Construct control charts for variables and attributes charts in a given situation.
- Apply the principles of random acceptance sampling.
- Illustrate single sampling plan and double sampling plan.
- State ABC standard plan
- Compute the probability of acceptance for a given product.
- Draw O.C operating characteristic curves.

SUGGESTED E RESOURCES/STUDENT ACTIVITIES

12. www.learnengineering.com
13. www.nptel.ac.in
14. www.onlinestudies.com
15. www.classcentral.com
16. A Case study on work-study measurement.
17. Prepare job specifications and job description for a specific job.
18. Compare various job evaluation methods for a real example.
19. Calculate earnings of workers using various wage differentials

CO-PO Matrix

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	Mapping Pos
18M504E(A).1	-	2	3	2	-	-	-	-	-	-	2,3,4
18M504E(A).2	3	1	2	2	-	-	-	-	-	-	1,2,3,4
18M504E(A).3	-	-	3	1	-	-	-	-	-	-	3,4
18M504E(A).4	3	-	1	1	2	-	-	-	-	-	1,3,4,5
18M504E(A).5	2	2	3	-	3	2	-	1	1	-	1,2,3,5,6,8,9
18M504E(A).6	3	1	3	2	-	-	-	-	-	-	1,2,3,4

QUESTION PAPER BLUE PRINT FOR CIE (MID SEM I)

Unit No	Unit Name	Questions to be set for CIE (Q. No)			Remarks
		R	U	A	
1	Work study-Method study	1 2	5(a) 5(b)	7(a) 7(b)	
2	Work study- Work measurement	3 4	6(a) 6(b)	8(a) 8(b)	

QUESTION PAPER BLUE PRINT FOR CIE (MID SEM II)

Unit No	Unit Name	Questions to be set for CIE (Q. No)			Remarks
		R	U	A	
3	Job evaluation and Merit rating	1 2	5(a) 5(b)	7(a) 7(b)	
4	Wage and Incentive systems	3 4	6(a) 6(b)	8(a) 8(b)	

BOARD DIPLOMA EXAMINATIONS (C18)

C18-Semester End Examination (SEE)

Model Paper- 18M504E (A)

INDUSTRIAL ENGINEERING

TIME: 2 Hours

Max. Marks: 40

PART – A

Marks: 8 X 1 M = 8M

NOTE: 1) Answer **all questions** and each question carries **one** mark.

2) Answers should be brief and straight to the point and shall not exceeding **three** simple sentences

1. Draw the process chart symbol for delay.
2. What is job description?
3. List two objectives of inspection.
4. What does LTPD stands for?
5. What is Sample inspection?
6. Define quality.
7. Write the formula to calculate upper control limit for p charts.
8. What are control charts?

PART – B

Answer **all questions** . Each question carries **three** marks

4x 3 M = 12M

9(a) Give any three advantages of time study.

OR

9(b) Draw the graph to show quality cost relationship.

10(a) Write about any one merit rating method.

OR

10(b) What are the advantages of control charts?

11(a) What are the various methods of inspection?

OR

11(b) What is quality conformance?

12(a) What are the functions of Statistical quality control?

OR

12(b) Illustrate single sampling plan schematically.

PART – C

Answer **all** questions . Each question carries **five** marks

4x 5 M = 20 M

13 (a) Prepare a material type flow process chart for a suitable example.

OR

13 (b) Explain in detail about centralized inspection.

14 (a) A management sets the target of completing 72 jobs for each worker. The hourly wage rate is Rs. 2/- and standard time set for each job is 8 hours, but worker could complete the job in 6 hours only. Compute the daily earnings 50-50 Halsey plan.

OR

14 (b) Draw and Explain main characteristics of an OC (operating characteristic) curve.

15 (a) Differentiate between inspection and quality control.

OR

15 (b) What are the functions of inspection department?

16 (a) The daily production in machine shop is 1000 items. These items are inspected by GO and NO GO gauges. A sample of 100 each is inspected daily for 10 days. The samples are taken at random. Compute the control limits for p-chart

Date	1	2	3	4	5	6	7	8	9	10
Rejection	2	10	6	20	18	14	15	12	8	6

OR

16 (b) Explain the terms AOQ and AOQL of acceptance sampling plans.

Model Paper

18M504E (A)

BOARD DIPLOMA EXAMINATIONS (C18)

INDUSTRIAL ENGINEERING

Mid -I (CIE)

Time: 1 Hour

Total Marks: 20 M

PART – A

Marks: 4 X 1M = 4 M

NOTE: 1) Answer **all** questions and each question carries **one** mark.

2) Answers should be brief and straight to the point and shall not exceed **three** simple sentences

- 1 Define Method study.
- 2 What is productivity?
- 3 List any two techniques of work measurement.
- 4 What is the process symbol for transport?

PART – B

Marks: 2 X 3M = 6 M

NOTE: 1) Answer **all** questions and each question carries **three** marks

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

- 5(a) Draw a neat sketch of a string diagram.

OR

- 5(b) Write a short note on SIMO chart.

- 6(a) Give any three advantages of PMTS.

OR

- 6(b) The observed time for an activity is 0.85 minutes. The rating factor is 90%. All allowances put together are 25% of normal time. Calculate Standard time?

PART – C

Marks : 2 X 5 M = 10 M

NOTE :

- 1) Answer **all** questions and each question carries **five** marks.
- 2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer

7(a) Prepare left hand and right hand chart for driving a nail in to the wall.

OR

7(b) List any ten-therblig symbols.

8(a) Describe the procedure to be followed for time study by stop-watch method.

OR

8(b) What are the various advantages and disadvantages of work sampling?

Model Paper

18M504E (A)

BOARD DIPLOMA EXAMINATIONS (C18)

INDUSTRIAL ENGINEERING

Mid –II (CIE)

Time : 1 hr

Total Marks : 20

PART – A

Marks: 4 X 1 M = 4 M

*NOTE: 1) Answer **all** questions and each question carries **one** marks.*

*2) Answers should be brief and straight to the point and shall not exceed **three** simple sentences*

1) What is job?

2) Define Merit rating.

3) Define the term base wage.

4) Write the formula to calculate the earnings of a worker using Rowan's plan.

PART – B

Marks: 2 X 3 M = 6 M

*NOTE: 1) Answer **all** questions and each question carries **three** marks*

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

5 (a) Enumerate the objectives of job evaluation.

OR

5 (b) Write a short note on incentive schemes for supervisory staff?

6(a) What are the various types of wages?

OR

6 (b) What are financial and non financial incentives?

PART – C

Marks: 2 X 05 M= 10 M

NOTE :

1) Answer **all** questions and each question carries **five** marks

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

7(a) Explain the classification method of job evaluation.

OR

7(b) Give disadvantages of merit rating.

8(a) Explain Halsey premium wage plan.

OR

8(b) If the standard time for a job is 21 hours and the rate per hour is Rs.1.00, Calculate the wages to be paid for a worker who finishes that job in 17 hours under Rowan's plan.

ESTIMATING & COSTING

Course Title : Estimating & Costing	Course Code : 18M504E(B)
Semester : V	Course Group : Elective
Teaching Scheme in Periods (L:T:P:) : 45:15:0	Credits : 3
Methodology : Lecture +Tutorials	Total contact periods : 60
CIE : 60 Marks	SEE : 40 Marks

Prerequisites: Basic knowledge of Geometry

COURSE OUTCOMES

	At the end of the course the students will have the ability to:
1	Understand the fundamentals of estimation.
2	Identify and estimate elements of cost in various processes and interpret
3	Evaluate life of machine using various methods of depreciation.
4	Estimate the weights of material required for a component.
5	Determine the machining times for various machining operations.
6	Estimate fabrication costs, forging and foundry costs to suggest cost reduction.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Periods	Questions to be set for SEE (Q No)				Remarks
			R		U	A	
1	Fundamentals of Estimation	10	4	1	9(a)	13(a)	
2	Elements of costing	10					
3	Depreciation	10		2	10 (a)	14 (a)	
4	Estimation of weights	10					

5	Estimation of machine times	10			5, 6	9(b), 11(a), 11(b)	13(b), 15(a), 15(b)	
6	Estimation of fabrication costs, forging costs and foundry costs	10		3	7, 8	10(b), 12(a), 12(b)	14(b), 16(a), 16(b)	

Legend: R; Remembering, U: Understanding A: Applying

COURSE CONTENT

Unit – 1

Duration: 10 Periods (L: 6.0 – T: 4.0)

Introduction to Estimating

Explanation of the term, objectives and functions of estimating –qualities of estimator-principal constituents of the estimating of the cost of component - design time, drafting, planning and production time, design and procurement or manufacture of special tools and equipment, estimate work, labour, materials, overheads, miscellaneous expenses - estimating procedure-estimating and costing differences.

Unit – 2

Duration: 10 Periods (L: 6.0 – T: 4.0)

Elements of costing

Explanation of term costing - objectives of cost accounting - elements of cost viz., material, labour and expenses - Determine the items that go into prime cost. On cost, calculate the cost of a product taking into consideration all items. Calculate the selling price of a product.

Unit – 3

Duration: 10 Periods (L: 6.0 – T: 4.0)

Depreciation

Introduction- Causes of depreciation-Methods for calculating depreciation- straight line method -diminishing balance method-sinking fund method-Formulae advantages and disadvantages -simple problems on all the above methods of depreciation.

Unit – 4**Duration: 10 Periods (L: 6.0 – T: 4.0)****Estimation of weights of materials**

Principles of dividing the component drawing into simple and smaller geometrical configurations.-Calculation of volume and the weight of the material- Estimating the cost of material- Exercises on calculation of weights of material and cost.

Unit – 5**Duration: 10 Periods (L: 6.0 – T: 4.0)****Estimation of machining times**

Basic formulas for the calculation of machining times for the operations such as turning, drilling, shaping, boring, screw cutting and grinding- Use of standard table feeds, cutting speed etc- Exercises on calculation of machining time for the above mentioned operations.

Unit – 6**Duration: 10 Periods (L: 6.0 – T: 4.0)****Estimation of fabrication, forging and foundry costs**

Explain the term fabrication – types- estimate the cost of fabrication by gas welding and arc welding - estimate the cost of gas cutting - exercises for the calculation of fabrication cost-forging-types-operations-losses-Components of forging cost-estimation of stock length, net weight, gross weight- losses in forging- estimation of stock size-Process for finding the foundry cost, cost of metal, cost of metal melting, moulding cost, core cost, cleaning cost, grinding and tooling cost.-Methods of estimating the above. Simple problems on estimation of forging and foundry cost.

REFERENCE BOOKS

1. Introduction to Work study by ILO
2. Work study by Ralph & Barnes
3. Industrial Engineering & Management Science by TR Banga
4. SQC by Juran
5. SQC by Grant & Levenworth
6. Estimating & Costing by Agarwal
7. Estimating & Costing by Narang & Acharya
8. Estimating & Costing by TR Banga & Sharma

SUGGESTED LEARNING OUTCOMES

Fundamentals of estimating

- Meaning of Estimation- necessity
- State the objectives of estimation.
- State the functions of estimation.
- Identify qualities of estimator.
- Explain the principal constituents of estimating the cost of a component.
- Elaborate the estimating procedure.
- Differentiate between estimating and costing.

Elements of costing

- Discuss various elements of cost-material,
- State the objectives of costing.
- Explain the classification of cost-direct material, direct labour and overheads .
- Classify overheads.
- Define Prime cost, factory cost, production cost, total cost and selling price.
- Discuss the relation between elements of cost and components of cost.
- Calculate selling price of a product-simple exercises.

Depreciation

- Define depreciation
- Discuss the causes of depreciation.
- List the methods of calculating depreciation
- Elaborate the straight line method of depreciation.
- Explain diminishing balance method of depreciation.
- Explain sinking fund method of depreciation
- Solve the simple exercises on the above methods of calculating depreciation.

Estimation of weights of materials

- Review of mensuration formulae for regular 2D figures including fillets, segments of circles.
- Review of mensuration formulae for regular 3D solids including solids of revolutions and segments.
- State Guldinus rule.
- Principles of dividing the component drawing into simple and smaller geometrical configurations.
- Show the table showing the specific weights of important engineering materials.
- Practice Simple problems on estimation of weights of various machine components.

Estimation of machining times

- Meaning of cutting speed – feed–depth of cut- machining time-purpose of calculating machining time
- Formulae for all basic turning times
- Simple problems on estimation of turning times
- Formulae for Drilling – screw cutting times
- Simple problems on estimation of drilling time
- Formulae for shaping and grinding -cutting times
- Simple problems on estimation of shaping and grinding time

Estimation of fabrication, forging cost and foundry cost

- Elaborate Welding and Types of welding.
- State the Oxy-acetylene gas welding principle – rightward and leftward techniques.
- Estimate gas welding time using tables
- Solve Simple problems on estimation of gas welding time
- Estimate arc welding cost considering various components
- Solve Simple problems on estimation of arc welding cost
- Explain Estimation of gas cutting cost and solve the problems
- Discuss Forging types, forging losses and forging operations
- Mention the various components considered while calculating forging cost(no problems)
- Discuss the Pattern allowances used in Foundry, net weight and gross weight
- Specify various components that go into foundry cost

SUGGESTED E RESOURCES/STUDENT ACTIVITIES

20. www.learnengineering.com
21. www.nptel.ac.in
22. www.onlinestudies.com
23. www.classcentral.com
24. www.lynda.com
25. Prepare a cost statement using Excel sheet for real time problem.
26. Prepare an Excel sheet for fabrication data tables
27. Estimate weights of some components.
28. Estimate the cost of fabrication in the work shop.

CO-PO Matrix

CO	P O1	P O 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	Mappi ng Pos
18M504E(B).1	3	2	2	-	-	-	-	-	-	-	1,2,3
18M504E(B).2	3	2	2	1	2	-	-	1	-	-	1,2,3,4, 5,8
18M504E(B).3	3	2	1	-	-	-	-	-	-	-	1,2,3
18M504E(B).4	3	2	1	-	-	-	-	-	-	-	1,2,3

18M504E(B).5	3	2	2	1	-	-	-	2	-	-	1,2,3,4, 8
18M504E(B).6	3	3	2	1	-	1	-	-	-	-	1,2,3,4, 6

QUESTION PAPER BLUE PRINT FOR CIE (MID I)

Unit No	Unit Name	Questions to be set for CIE(Q No)			Remarks
		R	U	A	
1	Fundamentals of Estimation	1	5(a)	7(a)	
		2	5(b)	7(b)	
2	Elements of Costing	3	6(a)	8(a)	
		4	6(b)	8(b)	

QUESTION PAPER BLUE PRINT FOR CIE (MID II)

Unit No	Unit Name	Questions to be set for CIE (Q No)			Remarks
		R	U	A	
3	Depreciation	1	5(a)	7(a)	
		2	5(b)	7(b)	
4	Estimation of weights	3	6(a)	8(a)	
		4	6(b)	8(b)	

Model Paper- 18M504E (B)

18M504E (B)

BOARD DIPLOMA EXAMINATIONS (C18)

ESTIMATING & COSTING

Mid Sem -I

Time : 1 Hour

Total Marks : 20 M

PART – A

Marks: 4 X 1M = 4 M

*NOTE: 1) Answer **all** questions and each question carries **one** mark.*

*2) Answers should be brief and straight to the point and shall not exceed **three** simple sentences*

1What is estimation?

2List any two allowances.

3Give two examples of office overheads?

4 What is the prime cost?

PART – B

Marks : 2 X 3M= 6 M

*NOTE: 1) Answer **all** questions and each question carries **three** marks*

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

5(a) Give any three qualities of an estimator.

OR

5(b) Write a short note on Overheads?

6(a) What are the elements of cost?

OR

6(b) Draw a block diagram for calculation of selling price.

PART – C

Marks : 2 X 5 M = 10 M

NOTE :

1) Answer **all** questions and each question carries **five** marks.

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer

7(a) What are the objectives of estimating?

OR

7(b) Explain the time allowances in detail.

8(a) Give any five examples of selling expenses.

OR

8(b) What are the various objectives of costing?

Model Paper- 18M504E (B)

18M504E (B)

BOARD DIPLOMA EXAMINATIONS (C18)

ESTIMATING & COSTING

Mid Sem–II (CIE)

Time: 1 hr

Total Marks: 20

PART – A

Marks: 4 X 1 M = 4 M

*NOTE: 1) Answer **all** questions and each question carries **one** marks.*

*2) Answers should be brief and straight to the point and shall not exceed **three** simple sentences*

1) What is depreciation?

2) Write the formula for calculating depreciation using straight-line method.

3) State the guildnus rule.

4) Draw a segment of sphere.

PART – B

Marks : 2 X 3 M = 6 M

*NOTE: 1) Answer **all** questions and each question carries **three** marks*

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

5 (a) Write a short note on depreciation due to obsolescence.

OR

5 (b) What is diminishing balance method for calculating depreciation?

6(a) What are the steps followed to calculate the material cost of a product?

OR

6 (b) Write a formula to calculate volume of frustum of cone and cylinder?

PART – C

Marks : 2 X 05 M= 10 M

NOTE :

1) Answer **all** questions and each question carries **five** marks

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

7(a) Define the terms book value, Scrap value, appreciation , depreciation and depreciation fund .

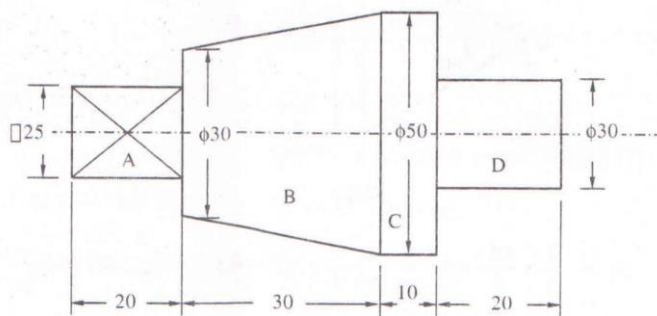
OR

7(b) A machine was purchased for Rs. 50,000/-. After 4 years, the value of the machine was estimated at Rs. 10,000. Find the depreciation using Straight line method.

8(a) Give the formulae to calculate area of rectangle, square, circle, parallelogram and triangle.

OR

8(b) The density of material for the part shown in figure is 8.5 gm/cc. Calculate the weight of the work piece and also the cost, if rate of material is Rs 30/kg.



All Dimensions are in mm

Model Paper- 18M504E (B)

18M504E (B)

BOARD DIPLOMA EXAMINATIONS (C18)

C18-Semester End Examination (SEE)

ESTIMATING & COSTING

TIME : 2 Hours

Max. Marks: 40

PART – A

Marks: 8 X 1 M = 8M

*NOTE : 1) Answer **all** questions and each question carries **one** mark.*

*2) Answers should be brief and straight to the point and shall not exceeding **three** simple sentences*

1. Define estimating.
2. Write the formula to find the volume of cylinder?
3. Define cutting speed.
4. Write two limitations of welding.
5. What is machining time?
6. Write is drilling?
7. List types of forging.
8. What is pattern allowance?

PART – B

*Answer **all** questions . Each question carries **three** marks*

4x 3 M = 12M

9(a) What are the main objectives of costing.

OR

9(b) A hollow spindle is bored to enlarge its hole diameter from 2.5 to 3 cm up to 12 cm depth in single cut. Estimate the boring time, if cutting speed is 30m/min and feed is 0.02 cm/rev.

10(a) What are the causes of depreciation? OR

10(b) Write a short notes on shrinkage or contraction allowance?

11(a) What is turning and write the formula to calculate time to turn L meter of length?

OR

11(b) List any six machining operations on a lathe.

12(a) Draw any three types of welded joints.

OR

12(b) Write about any three types of forging operations?

PART – C

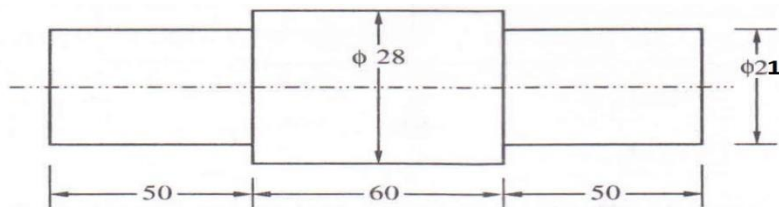
*Answer **all** questions . Each question carries **five** marks*

$$4 \times 5 \text{ M} = 20 \text{ M}$$

- 13 (a) A small firm is producing 100 pens per day. The direct material cost is Rs.160, direct labour cost is Rs. 200 and factory overheads are Rs 250. If selling overheads are 40% of factory cost, what is the selling price of each pen to realize a profit of 14.6% of the selling price.

OR

- 13 (b) Find the time required to turn 3.5 cm diameter bar to the dimensions shown in figure. Cutting speed is 15.4 m/min and feed is 1 mm/rev. All cuts are mm deep. All dimensions are in mm.



- 14 (a) A machine was purchased for Rs. 30,000/-. After 4 years, the value of the machine was estimated at Rs. 10,000. Find the depreciation using sinking fund method. The rate of interest being 5%.

OR

- 14 (b) Explain in detail the various forging losses.

- 15 (a) Estimate the time required for cutting threads of 3mm pitch on a mild steel bar of 32 mm diameter and 85 mm long. Assume cutting speed for threads as 15 m/min.

OR

- 15 (b) What is the purpose of calculating machine time?

- 16 (a) Two 1m long M.S plates of 10mm thick are to be welded by a lap joint with the help of 6mm electrode. Assume the following data. Calculate the cost of welding.

- a) Current used = 250 amperes
- b) Voltage = 30V
- c) Welding speed = 10m/hr
- d) Electrode used = 0.5 Kg/m of welding
- e) Labour charges = Rs 15/hr
- f) Power charges = Rs 1per Kwh
- g) Cost of electrodes = Rs 15/ Kg
- h) Machine efficiency = 60%

OR

- 16 (b) Explain various forging losses.

REFRIGERATION AND AIR CONDITIONING

Course Title :Refrigeration and Air Conditioning	Course Code :18M505E(A)
Semester : V	Course Group : Elective
Teaching Scheme in Periods (L:T:P) : 45:15:0	Credits : 3
Methodology: Lectures + Tutorials	Total contact periods: 60
CIE : 60 Marks	SEE : 40 Marks

Prerequisites: Basic knowledge of Thermodynamics

COURSE OUTCOMES

	On Successful completion of the course, the student will be able to
CO1	Outline various methods of refrigeration and analyze air refrigeration system.
CO2	Analyze & Understand vapour compression, vapour absorption refrigeration systems.
CO3	Acquire knowledge on refrigerants, various equipments used in refrigeration systems.
CO4	Develop knowledge on Air conditioning and understand psychrometry.
CO5	Learn about working of various air conditioning equipments.
CO6	Explain different applications of Refrigeration, Air conditioning systems and able to solve simple troubles in R&AC equipment.

COURSE CONTENT AND BLUE PRINT OF MARKS FOR SEE

Unit No	Unit Name	Periods	Questions to be set for SEE (Q No)				Remarks
			R		U	A	
1	Fundamentals of refrigeration and air refrigeration cycles	10	4	1	9(a)	13(a)	
2	Vapour compression and Vapour absorption refrigeration system	10					
3	Refrigerants and refrigeration equipment	10		2	10 (a)	14 (a)	
4	Fundamentals of A.C. and psychrometry	10					
5	Air distribution and air conditioning equipment	10		3	5, 6	9(b), 11(a), 11(b)	13(b), 15(a), 15(b)
6	Applications of refrigeration and air conditioning	10					

Legend: R; Remembering, U: Understanding A: Applying

COURSE CONTENT

Refrigeration and Air conditioning

Unit – 1

Duration: 10 Periods (L: 6.0 – T:4.0)

Fundamentals of Refrigeration and Air Refrigeration cycles:

Introduction - Definition of refrigeration - methods of refrigeration – Basic terms involved in Refrigeration – Thermodynamic analysis of air refrigeration cycles: Reversed Carnot Cycle – PV and TS diagram - Bell Coleman cycle – PV and TS diagram - derivation of equation for COP - Open air and closed air systems of refrigeration –problems on calculation of COP.

Unit – 2

Duration: 10 Periods (L: 6.0 – T:4.0)

Vapour compression Refrigeration Systems (VCRS) and Vapour Absorption Refrigeration Systems (VARs)

VCRS:-Principles –Thermodynamic analysis of VCRS – TS and PH diagram –COP - Factors effecting performance of VCRS - Wet and Dry compression –Receiver, Accumulator, Strainer, Drier and Flash chamber – Problems on COP on various states of refrigerant.

VARs:-Principles – Refrigerant & Absorbent pairs-Two Fluid VARs:- Working of Ammonia water vapour absorption refrigeration system – Working of Lithium Bromide-Water vapour absorption refrigeration system-Three Fluid VARs :- Electrolux refrigeration system.

Unit – 3

Duration: 10 Periods (L: 6.0 – T:4.0)

Refrigerants and refrigeration equipment

Refrigerants: - Definition - Primary and Secondary Refrigerants — Properties of good refrigerants – Commonly used refrigerants – Ozone Depletion, phase out of Chlorofluoro carbon refrigerants – Montreal and Kyoto protocols.

Refrigeration Equipments: - Compressors – Types of compressors, Condensers – types of condensers, Evaporators – types of evaporators, Expansion Devices – types of expansion Devices – Drier cum filter - strainer

Unit – 4

Duration: 10 Periods (L: 6.0 – T:4.0)

Fundamentals of A/c and Psychrometry

Fundamentals of A/C:- Definition of Air-conditioning - Classification of air conditioning systems - Human comfort conditions – Effective Temperature – Factors governing effective temperature – comfort chart.

Psychrometry:-Definition– Psychrometric terms – Carrier Equation - Psychrometric chart – Psychrometric processes – mixing of airstreams – simple problem on load calculation

Unit – 5

Duration: 10 Periods (L: 6.0 – T:4.0)

Air Distribution and Air-conditioning Equipment

Modes of Heat Transfer: – Heating & Cooling loads. **Air Distribution:-** General Air distribution (Air flow diagram for an Ac system). **Air Distribution System in a Room :-** Ejection system, Downward system and Upward system. **Ducts:** - Definition, Types, materials used, Duct system. Fans and Blowers – Supply air outlets – Filters and Dust Collectors – Heating and Cooling coils, AHU (Air Handling Units), Chillers.

Unit – 6

Duration: 10 Periods (L: 6.0 – T:4.0)

Applications of Refrigeration and Air-conditioning

Applications of Refrigeration :- Domestic refrigerator – Ice plant – Water cooler – Production of Dry Ice. **Applications of air conditioning:-** Window air conditioner, Desert/air cooler (**Evaporative cooling**), Summer air conditioning system – Winter air conditioning system – Year Round Air condition system – Central air conditioning system– Food preservation.

REFERENCE BOOKS

1. Refrigeration and Air Conditioning – by C. P Arora
2. Refrigeration and Air Conditioning – by Domakundwar
3. Basic Refrigeration and Air conditioning - by P N Ananthanarayana
4. Refrigeration and Air Conditioning – by Dosatt
5. Refrigeration and Air Conditioning – by Stoecker
6. Trouble shooting of Refrigeration -by Ananthanarayana

SUGGESTED LEARNING OUTCOMES

Fundamentals of Refrigeration and Air refrigeration Cycles

- Define refrigeration and know natural method and mechanical methods of refrigeration.
- Explain different methods of refrigeration such as ice, dryice, liquid nitrogen refrigeration.
- Define Refrigeration effect, Work of compression, COP, unit of refrigeration (Ton of refrigeration- TR), Evaluate the power required per Ton of Refrigeration.
- Analyze Reverse Carnot Cycle –draw PV and TS diagram - Know its limitations.
- Derive expression for COP of Reverse Carnot refrigeration cycle and solve problems on it.
- Analyze Bell-Coleman Cycle for Air Refrigeration with PV and TS diagram
- Deriver expression for COP of Bell-Coleman air refrigeration cycle and Solve problems on it.
- Differentiate open air system and closed air system.

Vapour compression and Vapour absorption refrigeration systems

- Explain working principle and working of vapour compression refrigeration system with the help of Schematic diagram, T-S and P-H diagrams. Write the expression for Coefficient of Performance (COP).
- Solve problems on Vapour compression refrigeration system.
- Distinguish between wet and dry compression. State the use of receiver, accumulator, strainer, drier and flash chamber.
- Summarize the effects of evaporator pressure, condenser pressure, under cooling and super heating on COP.
- Explain principle of simple vapour absorption systems. State the desirable properties of refrigerants -absorbers and list the commonly used refrigerant – absorber pairs.
- Know two fluid systems of Vapour Absorption Refrigeration System (VARs) – Explain the construction and working of Ammonia-Water VARs.
- Explain the construction and working of Water-Lithium Bromide VARs.
- Know three fluid systems of VARs – Explain the construction and working of Electrolux VARs.

Refrigerants and refrigeration equipment

- Distinguish between primary and secondary refrigerants; List the desirable properties of refrigerants and Classification of refrigerants.
- Write chemical formula, name and application of the following refrigerants – R 12, R 22, R 134 a, R 290a, R 600a, R 401a, Cyclopentane, R 717, R 718, R 729, R 744
- Know the reasons of Ozone depletion – Need to phase out of Chlorofluoro carbons and hydro Chlorofluoro carbons – Understand Montreal protocol and Kyoto protocol. (Statements of protocol).
- Know the function of compressor, Classification of compressors.
- Explain construction and working of hermetic reciprocating compressor.
- State the function of condenser and explain the working of natural draught air cooled condensers type (tube and fin condenser) –and forced draught air cooled condensers
- Explain the working of Shell & Tube water cooled condensers with the help of a legible sketch.
- Explain the working of evaporative condenser
- Explain the functions of various types of expansion devices such as capillary tube, thermostatic expansion valves with the help of a legible sketch.
- State the function of evaporator, explain construction and working principle of flooded type evaporator and dry expansion evaporator

Fundamentals of A/C and psychrometry

- Define air conditioning and classify air conditioning systems.
- Explain air conditioning as applied to human comfort, effective temperature, factors governing effective temperature and comfort chart.
- Define the terms Psychrometry, dry air and moist air, DBT, WBT, DPT and adiabatic saturation temperature, humidity, absolute humidity, relative humidity, specific humidity and degree of saturation.

- Know Carrier's equation and solve problems involving psychrometry.
- Know different Psychrometers - Laboratory, continuous recording, sling and aspirating Psychrometers.
- Explain the features of psychrometric chart, plot all psychrometric processes on the chart.
- Know the concept of mixing of air streams and solve problems.

Air distribution and Air-conditioning Equipment.

- Know the different modes of heat transfer – conduction, convection and radiation
- Draw the general air flow diagram for AC system and explain the air flow, explain different air distribution systems in a room like ejection system, downward system and upward system.
- Explain the need of a duct- Know duct materials, shapes, classify the ducts and explain the duct system based on arrangement of supply ducts like loop perimeter system, radial perimeter system and extended plenum system.
- Explain duct system based upon number of ducts used like: single duct system, dual duct system and dual duct with induction system.
- Differentiate between fan and blower, classify fans according to direction of air flow and know the factors governing selection of fans.
- Explain construction and working of different axial flow fans like propeller fan, tube axial fan and vane axial fan
- Know constructional features of forward curved, backward curved and radial fan blades
- Classify supply air outlets and know about grill outlets, slot diffusers, ceiling diffusers, perforated ceiling panels and their applications.
- Know different types of filters and dust collectors -Explain heating and cooling coils.
- Know the functioning of Air Handling Units (AHU) and chiller units.

Applications of refrigeration and air conditioning

- Applications of refrigeration - explain construction and working of domestic refrigerator.
- Explain the layout of ice plant and process of production of ice
- Explain construction and working of storage type water cooler.
- Explain the process of production of dry ice
- Applications of air conditioning – Explain working of window air conditioner.
- Know the difference between unitary air conditioner, split air conditioner- Explain the working of desert type air cooler.
- Explain summer air conditioning system for hot & humid and hot & dry out-door conditions .
- Explain winter air conditioning system for cold & dry out-door conditions - Explain year round air conditioning system.
- Explain central air conditioning system

SUGGESTED E RESOURCES / STUDENT ACTIVITIES.

1. Visit nearest outlet and list out Domestic Refrigerators manufacturers and know the capacity of the refrigerator and the refrigerant used in it.
2. Know the colour coding of refrigerant cylinders.
3. Make a report of Montreal and Kyoto protocols.
4. Assemble and disassemble the air cooler and know all the parts.
5. Clean an air cooler, replace the pads of an air cooler.
6. Visit a RAC workshop and watch the method of vaccumisation and charging of refrigerant.
7. Visit a duct manufacturing unit and study how fabrication is done and submit a report.
8. Visit a site where ducting is being carried out.
9. Collect data sheet to find heating and cooling loads for an air conditioning system and study its contents.
10. Visit a site where split air conditioner is being installed.
11. Visit a central air conditioning plant.
12. Working of domestic refrigerator
: <https://www.youtube.com/watch?v=h5wQoA15OnQ&vl=en>
13. Working of window air conditioner:
<https://www.youtube.com/watch?v=0PkOEHMNOLk>
14. Working of Air handling unit (AHU)
<https://www.youtube.com/watch?v=uWwVsFqNFp4>
15. Working of chiller
<https://www.youtube.com/watch?v=0rzQhSXVq60>
16. Working of ductable air conditioning system
https://www.youtube.com/watch?v=ye_r_JY5Vyg
17. Working of tube axial fan
<https://www.youtube.com/watch?v=OvVcZrIWcF8>
18. Working of vapour compression system
https://www.youtube.com/watch?v=-Wj_MO4BqtA
19. Working of Ammonia Water VARS
<https://www.youtube.com/watch?v=xDDmlT-HK1Y>
20. Working of Water lithium bromide VARS
https://www.youtube.com/watch?v=L_wISd7bAWE
21. Working of Electrolux VARS
<https://www.youtube.com/watch?v=uHtOtgxAdRs>
22. Working of Receiver, Drier and Accumulator
<https://www.youtube.com/watch?v=7raEl5-5PEs>

CO-PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	Mapping POs
18M505E(A).1	1	3	-	-	-	-	-		-	-	1, 2
18M505E(A).2	3	3	-	-	-	-	-		3	2	1, 2, 9, 10
18M505E(A).3	1	3	2	-	3	2	-	3	-	2	1, 2, 3, 5, 6, 8, 10
18M505E(A).4	1	1	1	-	-	-	-		-	-	1, 2, 3, 9
18M505E(A).5	2	2	1	-	-	-	-	1	-	-	1, 2, 3, 8
18M505E(A).6	1	2	1	-	-	-	-	2	-	1	1, 2, 3, 8, 10

QUESTION PAPER BLUE PRINT FOR CIE (MID SEM I)

Unit No	Unit Name	Questions to be set for CIE (Q No)			Remarks
		R	U	A	
1	Fundamentals of Refrigeration and Air conditioning	1	5(a)	7(a)	
		2	5(b)	7(b)	
2	Vapour Compression and Vapour Absorption Refrigeration system	3	6(a)	8(a)	
		4	6(b)	8(b)	

QUESTION PAPER BLUE PRINT FOR CIE (MID SEM II)

Unit No	Unit Name	Questions to be set for CIE (Q No)			Remarks
		R	U	A	
3	Refrigerants and Refrigeration equipment	1	5(a)	7(a)	
		2	5(b)	7(b)	
4	Fundamentals of A/C and Psychrometry	3	6(a)	8(a)	
		4	6(b)	8(b)	

BOARD DIPLOMA EXAMINATIONS (C18)
MID SEM I EXAMINATION
DME V SEMESTER
REFRIGERATION AND AIR CONDITIONING

Time : 1 Hour

Total Marks : 20 M

PART – A

Marks: 4 X 1M = 4 M

*NOTE: 1) Answer **all** questions and each question carries **one** mark.*

*2) Answers should be brief and straight to the point and shall not exceed **three** simple sentences*

1. Define the term Refrigeration. Write its units.
2. Find COP of a refrigerating machine working on Reverse Carnot cycle operating between -10°C and 40°C .
3. Why dry compression is preferred in VCRS.
4. Why Ammonia-Water is most prominently used as Refrigerant-Absorbent in VARS.

PART – B

Marks: 2 X 3M = 6 M

*NOTE: 1) Answer **all** questions and each question carries **three** marks*

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

5. (a). Explain about dry ice refrigeration
OR
5. (b). Differentiate open and closed cycle refrigeration system.
6. (a). Draw the layout of water-lithium bromide VARS..
OR
- 6 (b). Draw layout of Electrolux refrigeration system.

PART – C

Marks : 2 X 5 M = 10 M

NOTE :

1. Answer **all** questions and each question carries **five** marks.
2. The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer

7(a) Explain Bell Coleman refrigeration cycle with a layout.

OR

7(b) A refrigeration plant works between -15°C and 30°C . The refrigerant is dry and saturated at the end of compression. Calculate Refrigerating effect, Carnot COP and COP of VARS, if enthalpy values before and after compression are 1280 kJ/kg and 1470 kJ/kg, fluid enthalpy at 30°C is 320 kJ/kg.

8 (a) Explain with help of Pressure-Enthalpy (P-H) diagram the effect of increase in condenser pressure on refrigeration system performance.

OR

8 (b) Differentiate between wet compression and dry compression refrigeration system.

BOARD DIPLOMA EXAMINATIONS (C18)
MID SEM II EXAMINATION
DME V SEMESTER
REFRIGERATION AND AIR CONDITIONING

Time : 1 Hour

Total Marks : 20 M

PART – A

Marks: 4 X 1M = 4 M

*NOTE: 1) Answer **all** questions and each question carries **one** mark.*

*2) Answers should be brief and straight to the point and shall not exceed **three** simple sentences*

1. What is a primary refrigerant. Give an example.
2. What is chemical formula of R-22.
3. How does an air conditioning differs from refrigeration.
4. Define the term specific humidity.

PART – B

Marks : 2 X 3M= 6 M

*NOTE: 1) Answer **all** questions and each question carries **three** marks*

2) The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer.

5. (a) Write short notes on Montreal protocol
OR
5. (b) Differentiate between natural draught and forced draught condensers.
6. (a) What are the factors governing effective temperature
OR
- 6 (b) Explain working of aspirating psychrometer.

PART – C

Marks : 2 X 5 M = 10 M

NOTE :

3. Answer **all** questions and each question carries **five** marks.
4. The answers should be comprehensive and the criteria for valuation is the content but not the length of the answer

7(a) Explain working of evaporative condenser.

OR

7(b) Explain working of thermostatic expansion valve.

8 (a) Draw sensible heating, sensible cooling, humidification and dehumidification process on psychrometric chart.

OR

8 (b) Explain the concept of mixing of air streams in air conditioning.

BOARD DIPLOMA EXAMINATIONS (C18)
MODEL PAPER (SEE)
DME V SEMESTER
REFRIGERATION AND AIR CONDITIONING

TIME : 2 Hours

Max. Marks: 40

PART – A

Marks: 8 X 1 M = 8 M

*NOTE : 1) Answer **all** questions and each question carries **one** marks.*

*2) Answers should be brief and straight to the point and shall not exceeding **three** simple sentences*

1. Define the term Ton of Refrigeration.
2. What is the function of accumulator in VCRS.
3. Write any two duct materials.
4. Write carriers equation.
5. Write two materials used for ducts in air distribution.
6. What is relative humidity of Hyderabad.
7. What are main components in indoor unit of split air conditioner.
8. What does AHU stands for?

PART – B

*Answer **all** questions . Each question carries **three** marks*

4x 3 M = 12M

9(a) Write an expression for COP of refrigerator and heat pump of reverse Carnot cycle

OR

9(b) Explain working of electronic filters.

10(a) What are secondary refrigerants give two examples.

OR

10 (b) Explain working of an air cooler

11 (a) Differentiate slot diffuser and ceiling diffuser.

OR

11(b) Differentiate conduction and convection heat transfer

12(a) Draw the layout for production of dry ice.

OR

12(b) Draw the layout for storage type water cooler.

PART – C

*Answer **all** questions. Each question carries **five** marks*

4x 5 M = 20 M

13 (a) Explain Bell Coleman refrigeration cycle .

OR

13 (b) Explain radial perimeter duct system with a neat sketch.

14 (a) Explain working of hermetic reciprocating compressor.

OR

14 (b) Explain working of storage type water cooler.

15 (a) Explain ejector type air distribution system.

OR

15 (b) Explain loop perimeter duct system.

16 (a) Explain summer air conditioning system for hot and humid outdoor conditions

OR

16 (b) Explain working of a window air conditioner.

CourseTitle : Fluid Power Engineering	Course Code : 18M505E(B)
Semester : V	Course Group : Elective
Teaching Scheme in Hrs (L:T:P) : 45:15:0	Credits : 3
Methodology : Lecture + Tutorials	Total Contact Periods : 60
CIE : 60 Marks	SEE : 40 Marks

Pre requisites

Basic Knowledge of hydraulics, pneumatics and control systems

Course Outcome

On successful completion of the course, the students will be able to attain below Course Outcome (CO):

Course Outcome	
CO1	Explain and Evaluate Hydraulic and Pneumatic Pump
CO2	Explain and differentiate Hydraulics motors
CO3	Describe the construction of various directional, Pressure and Flow control valves.
CO4	Hydraulic circuit design and Analysis.
CO5	Understand and explain Actuators
CO6	Design the single Actuator Circuits

Course content and Blue Print of Marks for SEE

Unit Name		Questions to be set for SEE Marks					Remarks	
		•						
		periods	R		U	A		
PART-A	Introduction to hydraulics and pumps	10	Q4	Q1		9(a)	13(a)	
	Hydraulic Motors and Actuators	10						
PART-B	Directional pressure and flow control valves	10		Q2		10(a)	14(a)	
	Hydraulic circuit design and analysis	10						
PART-C	Introduction to pneumatics and actuators	10		Q3	Q5 Q6	9(b) 11(a) 11(b)	13(b) 15(a) 15(b)	
	Single Actuator circuits	10			Q7 Q8	10(b) 12(a) 12(b)	14(b) 16(a) 16(b)	
TOTAL		60	10	8		06	06	

COURSE CONTENT

UNIT-I

Introduction to Hydraulics and Hydraulic pumps

Duration: 10 Periods (L: 6.0 – T:4.0)

Definition and scope of fluid power, Advantages and drawbacks of fluid power, Applications of fluid power, Components of Fluid power system - Hydraulic & Pneumatic systems Comparison between Hydraulic and Pneumatic Systems, Comparison of Different Power Systems -mechanical, electrical, hydraulic and pneumatic power systems, Future of Fluid power industry - in general and related to India. Classification of pumps based on Displacement, Delivery and Motion, Positive and Non-positive displacement pumps, Advantages and disadvantages of Non-positive displacement pumps Differences between Positive and Non positive displacement pumps, Classification of positive displacement pumps Pumping Theory, Gear pumps - External and internal gear pumps, Lobe and Screw pumps, Advantages, Disadvantages and applications of the above pumps, Vane pumps - Unbalanced and Balanced vane pumps, Advantages, Disadvantages and applications of vane pumps, Piston Pumps - Axial and Radial Piston Pumps Bent - Axis type and Swash - P Advantages, Disadvantages and applications of vane pumps, plate type piston pumps, Advantages, Disadvantages and applications of piston pumps, Volumetric and Mechanical efficiencies of pumps.

UNIT-2

Duration: 10 Periods (L: 6.0 – T:4.0)

Hydraulic Motors and Actuators

Introduction- Differences between hydraulic pump and motor, Applications of hydraulic motors, Comparison between hydraulic and electric motors, Classification of hydraulic motors, Gear motors, Vane motors, Piston motors, Theoretical torque, power and flow rate, Volumetric, Mechanical and Overall efficiencies of hydraulic motor. Introduction- Classification of actuators, Types of hydraulic cylinders – Single acting - Gravity return and spring return single acting cylinders, Double-acting - Piston rod on one side and both the sides, Telescope and Tandem cylinders, Cylinder force, velocity and power, First, Second and Third Class lever systems used in cylinders, Cylinder cushions and its importance.

UNIT-3**Duration: 10 Periods (L: 6.0 – T:4.0)****Directional, pressure and Flow control valves**

Introduction to valves used in fluid power, Functions of direction control valves, Classification of direction control valves on different criteria, Classification of DCVs based on Fluid Path, Design Characteristics, Control Method, Construction of Internal Moving Parts, Symbols of various direction control valves, Different types of actuators - Manually operated, mechanically operated, Solenoid operated and Pilot operated actuators, Check valve – construction and operation details of Ball type, Poppet, Pilot operated and Solenoid actuated check valves, Two way and Three way control valves and their applications. Necessity and functions of pressure control valves, Classification of pressure control valves, Pressure relief valves - construction and working of simple and compound (pilot operated) pressure relief valves, Pressure reducing valves, Unloading valves - Direct Acting and Pilot operated unloading valves - construction and operation, Counter balance valves, Pressure sequence valves, Cartridge valves - Balanced and unbalanced poppet controlled cartridge valves, Applications of pressure control valves. Functions of flow control valves, Classification of flow control valves, Construction and operation of Non - pressure compensated and Pressure compensated flow control valves.

UNIT-4**Duration: 10 Periods (L: 6.0 – T:4.0)****Hydraulic circuit design and Analysis**

Describing the operation of complete hydraulic circuits drawn using graphic symbols for all components, Control of single - acting hydraulic cylinder, Control of double - acting hydraulic cylinder, Regenerative cylinder circuit – expression for the cylinder extending speed, Load carrying capacity during extension, Pump unloading circuit, Double - pump hydraulic circuit, Counter balance valve application, Hydraulic cylinder sequencing circuit, Cylinder synchronizing circuits - cylinders connected in parallel and series, Fail - safe circuits, fail - safe system with overload protection, Two - handed safety system.

UNIT-5 Duration: 10 Periods (L: 6.0 – T:4.0)

Introduction to Pneumatics and Actuators

Introduction to Pneumatics, Choice working medium and system, Advantages and disadvantages of compressed air, Applications of pneumatics, Basic components of pneumatic systems, Advantages and disadvantages of

pneumatic systems, Comparison of Mechanical / Electrical, Hydraulic and Pneumatic transmission systems Introduction to pneumatic actuators, Types of pneumatic actuators – Linear actuators (pneumatic cylinders), Rotary actuators (Air motors) and Limited angle actuators, Classification of Linear actuators based on, Application for which cylinders are used, cylinder's action, cylinder's movement and cylinder's design, Materials of construction for light, medium and heavy duty cylinders, Single acting cylinders - construction of Diaphragm cylinder, Rolling diaphragm cylinders, Gravity return and Spring return single acting cylinders, Construction of double - acting cylinders with piston rod on one side and both the sides, Telescopic cylinder, Tandem cylinder, Rodless cylinder, Cable cylinder, Sealing band Cylinder with slotted cylinder barrel, Cylinder with Magnetically Coupled Slide, Impact cylinders and Duplex cylinders, Graphic symbols of cylinders, Cylinder Seals - characteristics and classification, Static and Dynamic seals, Different types of cylinders used in cylinders, Working and applications of Air Motor.

UNIT-6 Duration: 10 Periods (L: 6.0 – T:4.0)

Single Actuator circuits.

Functions of the pneumatic circuits, Direct and indirect control of single acting cylinders, Control of single acting cylinder with OR, AND, NOT valves, Direct and indirect control of double acting cylinders, Control of double acting cylinders with Supply air - throttling, Exhaust air throttling, Time dependent controls - Time delay valve NC-type, Time delay valve NO-type.

REFERENCE BOOKS

1. Fluid power with applications by Anthony Esposito - Printice Hall of India
2. Fluid power control - NPTEL Web course
3. Pneumatics by SRIHARI RAO
4. Pneumatic controls by FESTO
5. Fluid Power Pneumatics by ALAN H. JOHN
6. Pneumatics by FLIPPO
7. Pneumatics By TTI
8. Hydraulics & Pneumatics by RAY & RAOd
9. Fluid Power & Pneumatics by AUDEL Series

E resources/ suggested student activities

1. <https://www.youtube.com/watch?v=YImRa-9zDF8> basics
 2. <https://www.youtube.com/watch?v=8xd7cWvMrvE> nptel
 3. <https://www.youtube.com/watch?v=p7kaKmwC09g> practical examples
1. visit nearby JCB cranes, tippers and identify pneumatic devices and circuits and prepare a report about their working and their location.

Suggested learning outcomes.

On successful completion of the course the student shall be able to

1. Explain and Evaluate Hydraulics, Pneumatics and Pump

- Explain the meaning of fluid power.
- List the various applications of fluid power.
- Differentiate between fluid power and transport systems.
- List the advantages and disadvantages of fluid power.
- Explain the industrial applications of fluid power.
- List the basic components of the fluid power.
- Explain the meaning of Pneumatics.
- Differentiate between electrical, pneumatic and fluid power systems.
- Appreciate the future of fluid power in India.
- Classify the hydraulic pumps used in the industry.
- Differentiate between positive displacement and non-positive displacement pumps.
- Explain the working and construction of gear, vane and piston pumps.
- Define mechanical, volumetric and overall efficiency of pumps.
- Differentiate between internal and external gear pumps.

2 Explain and differentiate Hydraulics motors and actuators

- Differentiate between a hydraulic motor and a hydraulic pump.
- List various applications of hydraulic motor in fluid power.
- Discuss various classifications of hydraulic motor.
- Explain the construction and working of gear, vane and piston motors.
- Explain various types of efficiency terms used in hydraulic motors.
- Determine the torque and power delivered by hydraulic motors
- Explain the classification of hydraulic actuators.
- Explain various types of hydraulic cylinders.
- Describe the construction and working of double-acting cylinders.
- Derive an expression for force, velocity and power for hydraulic cylinders.
- Analyze various lever systems using hydraulic cylinders.
- Explain the importance of cylinder cushioning.

3 Describe and constructions of various directional, Pressure and Flow control valves.

- List different types of valves used in fluid power.
- Explain various classifications of directional control valves.
- Describe the working and construction of various direction control valves.
- Identify the graphic symbols for various types of direction control valves.
- Explain the different applications of direction control valves.

- Explain the working principle of solenoid-actuated valves.
- Define valve overlap.
- Evaluate the performance of hydraulic systems using direction control valves.
- Explain various functions of pressure-control valves.
- Explain various classifications of pressure-control valves.
- Describe the working construction of various pressure-control valves.
- Differentiate between a pressure relief valve, a pressure-reducing valve, a sequence valve and unloading valve.
- Identify the graphic symbols for various types of pressure-control valves.
- Explain different applications of pressure-control valves.
- Explain various functions of flow-control valves.
- Explain various classifications of flow-control valves.
- Describe the working and construction of various non-compensated flow control valves.
- Differentiate between compensated and non-compensated flow-control valves.
- Identify the graphic symbols for various types of flow-control valves.
- Explain different applications of flow-control valves.

4. Hydraulic circuit design and Analysis.

- Identify the graphic symbols for various types of hydraulic components.
- Explain various hydraulic circuits to control single-acting and double acting cylinders.
- Explain a regenerative circuit and determine the load-carrying capacities.
- Describe the working of a double-pump circuit along with its advantages.
- Explain the working of a sequencing circuit and a counterbalancing circuit.
- Differentiate between series and parallel synchronization circuits.

5. Understand and explain Actuators.

- Explain the meaning of Pneumatics
- Describe the various properties desired of a air medium in pneumatic system
- Explain the advantages and disadvantages of compressed air
- Identify and appreciate the application of pneumatic systems in various Industries
- List the basic components required for a pneumatic systems
- Describe the various power transmission systems
- Compare hydraulic, pneumatic and mechanical systems.
- Explain the meaning of Pneumatic Actuator
- Classify the various types of Pneumatic actuators
- Explain the working of various pneumatic actuators
- Study the seals used in the Pneumatic actuators
- Explain the working and application of air motors

6. Design the single Actuator Circuits.

- Differentiate between pneumatic circuit and pneumatic circuit diagram
- State basic rules used in design of pneumatic circuits
- Explain the memory, delay, OR, AND and NOT functions
- Explain the direct and indirect control of single acting cylinder
- Explain the direct and indirect control of double acting cylinder
- Differentiate supply and exhaust air throttling
- Design pressure and time dependent circuits

Course Outcome		CL	Linked PO
CO1	Explain And Evaluate Hydraulic and Pneumatic Pump	R, U, A	1,2,3,
CO2	Explain and differentiate Hydraulics motors	R, U, A	1,2,3,10
CO3	Describe the construction of various directional, Pressure and Flow control valves.	U, A	1,2,3,
CO4	Hydraulic circuit design and Analysis.	U, A	1,2,3,10
CO5	Understand and explain Actuators	U, A	1,2,3,10
CO6	Design the single Actuator Circuits	R, U, A	1,2,3,10
		Total Sessions	

Legends: R = Remember U= Understand; A= Apply and above levels (Bloom's revised taxonomy)

Course-PO Attainment Matrix

Course	Program Outcomes									
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	3	3							1
CO2	3	3	3							
CO3	3	3	3							
CO4	3	3	3			2				
CO5	3	3	3							1
CO6	3	3	3							1

Level 3- Highly Addressed, Level 2-Moderately Addressed, Level 1-Low Addressed.

MID SEM-I EXAM

S.No	Unit Name	R	U	A	Remarks
1	Unit-I	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Unit-II	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

MID SEM –II EXAM

S.No	Unit Name	R	U	A	Remarks
1	Unit-III	1, 2	5(a) 5(b)	7(a) 7(b)	
2	Unit-IV	3, 4	6(a) 6(b)	8(a) 8(b)	
Total Questions		4	4	4	

Semester End Examination

Sl No	Unit No.	Questions to be set for SEE				Remarks
		R		U	A	
1	I	4	1	9(a)	13(a)	
2	II					
3	III		2	10(a)	14(a)	
4	IV					
5	V		3	5, 6	9(b)	13(b)

					11(a)	15(a)	
					11(b)	15(b)	
6	VI			7,8	10(b)	14(b)	
					12(a)	16(a)	
					12(b)	16(b)	
Total Questions		8			8	8	

Legend:	Remembering (R)	1 Mark
	Understanding (U)	3 Marks
	Application (A)	5 Marks

18M505E(B)

BOARD DIPLOMA EXAMINATIONS (C18)

MID SEM I

MODEL PAPER

Fluid Power Engineering

Time : 1 Hour]

[Total Marks: 20

- Instructions :**
1. Answer **ALL** questions.
 2. Each question carries **ONE** mark.

- 1 Explain the meaning of fluid power. 04x01=04 M
- 2 List the advantages.
- 3 State the various types of hydraulic cylinders.
- 4 Analyze various level systems using hydraulic cylinders.

PART-B

02X03=06M

- Instructions :**
1. Answer any **TWO** questions.
 2. Each question carries **THREE** marks.

5. (a) Classify the hydraulic pumps used in industry.
(or)
5. (b) Explain the meaning of pneumatics.
6. (a) Explain hydraulic motors.
(or)
6. (b) Explain hydraulic pumps.

PART-C

- Instructions :**
1. Answer any **TWO** questions. 05X02=10M
 2. Each question carries **FIVE** marks.

7. (a) List the basic components of the fluid power.
(or)
7. (b) Write short notes of internal gear pumps.
8. (a) State the importance of cylinder cushioning.
(or)
8. (b) Write the formula for theoretical power and flow rate of hydraulic motor.

18M505E(B)

BOARD DIPLOMA EXAMINATIONS (C18)
MID SEM II
MODEL PAPER
Fluid Power Engineering

Time : 1 Hour]

[Total Marks: 20

-
- Instructions :**
1. Answer **ALL** questions.
 2. Each question carries **ONE** mark.

1. State different types of valves used in fluid power. 04x01=04 M
2. Define valve overlap.
3. Draw synchronization circuit.
4. Draw counter balance circuit.

PART-B

02X03=06M

- Instructions :**
1. Answer any **TWO** questions.
 2. Each question carries **THREE** marks.

5. (a) Distinguish between pressure relief valve and pressure reducing valve.
(or)
5. (b) identify the applications of flow control valves.
6. (a) Compare the cylinders connected in parallel with series.
(or)
6. (b) List the hydraulic components.

PART-C

- Instructions :**
1. Answer any **TWO** questions. 05X02=10M
 2. Each question carries **FIVE** marks.

7. (a) Explain the working principle of solenoid actuated valves..
(or)
7. (b) State the applications of directional control valves.
8. (a) State the applications of counter balance valve.
(or)
8. (b) Construct the Pressure compensated flow control valves.

18M505E(B)

BOARD DIPLOMA EXAMINATIONS (C18)
SEE-MODEL PAPER
DME– III SEMESTER EXAMINATION

Fluid Power Engineering

Time : 2 Hours]

[Total Marks: 40

PART-A

08X01=08

- Instructions :**
1. Answer **ALL** questions.
 2. Each question carries **ONE** mark.

1. List the various applications of fluid power system.
2. What is the purpose of directional control valve?
3. State the types of pneumatic timers.
4. Write the classification of hydraulic motors.
5. State Boyle's law.
6. List various types of pneumatic actuators.
7. State the basic rules used in design of pneumatics.
8. State the function of pneumatic circuits.

PART-B

04X03=12

- Instructions :**
1. Answer any **FOUR** questions.
 2. Each question carries **THREE** marks.

9. (a) State the components of fluid power system
(or)
9. (b) State the advantages of compressed air.

10. (a) State the functions of pneumatic control valves.
(or)
10. (b) What is time dependent controls?
11. (a) Explain air motors.
(or)
11. (b) Explain the construction of diaphragm cylinder
12. (a) Explain Exhaust air throttling.
(or)
12. (b) State AND and NOT valves.

PART-C

04X5=20

Instructions : 1. Answer any **FOUR** questions.

2. Each question carries **FIVE** marks.

13. (a) Draw the graphic symbols for fixed and variable displacement pumps.
(or)

13. (b) State the applications of counter balance valve

14. (a) What is the purpose of a sequence valve.
(or)

14. (b) State the types of speed control of double acting cylinder.

15. (a) State the applications of pneumatic systems.
(or)

15. (b) Explain protection against overload.

16. (a) Explain indirect control of double acting cylinder. (or)

16. (b) Illustrate the difference between supply and exhaust air throttling.

CAM LAB

Course Title :	CAM LAB	Course Code	18M506P
Semester	V	Course Group	:Practical
Teaching Scheme in Periods(L:T:P)	15:00:30	Credits	: 1.5
Methodology	Lecture + Practical	Total Contact Periods :	:45
CIE	60 Marks	SEE	40 Marks

Pre requisites

This course requires the basic knowledge of manufacturing process and Auto CAD

COURSE OUTCOMES

At the end of the course the students will have the ability:	
CO1	Identify the parts and functions of CNC lathe
CO2	Apply incremental system and absolute system on dimensioning understand different types of interpolation.
CO3	Understand simulation screen different operations
CO4	Prepare simple part program using G-Codes and M-Codes for various operations.
CO5	Execute a part program using CNC lathe machine simulation package.
CO6	Prepare part program as per the drawing and produce parts as per drawing using cycles

OBJECTIVES

Up on completion of the course the student shall be able to

1. Identify the parts and functions of CNC lathe
2. Use incremental system and absolute system on dimensioning.
3. Understand the meaning and usage of G & M codes
4. Write simple part program using G-Codes and M-Codes as per the drawing.
5. Edit and execute a part program using CNC lathe machine simulation package.
6. Know the fixing of tools and operation of tool turret.
7. Know the tool offsetting
8. Produce part as per the drawing using CNC lathe machine.

COURSE CONTENT

1. CNC Introduction
2. Study of CNC lathe.
3. G – codes and M- codes/ Structure of program
4. Simulation software practice.
5. Simple CNC operations
6. Simple facing and turning.
7. Turning exercise – step turning using canned cycle.
8. Turning exercise – circular interpolation CW, CCW.
9. Turning Exercise - Taper turning and Peck drilling cycles.
10. Turning exercise – Thread cutting and grooving cycles.

Note: *The simulation software available in the market:*
FANUC, SIEMENS, HI NUMERIC, GSK etc.,

Key competencies to be achieved by the student

S N	Exercise	Key competencies expected
1	Hands on practice on CNC machine	<ul style="list-style-type: none"> A. Identify the various parts and switches B. Identification of CNC machine axis. C. Operate the various parts and knobs of the machine - Switch on / off D. Move the tool turret in Z & X axis direction. E. Index the tool turret F. Spindle off/on coolant on/off
2	Practice turning Operation on CNC machine	<ul style="list-style-type: none"> A. Use incremental system and absolute system of co-ordinate system B. Use appropriate tools for turning C. Select the speeds and feeds used for turning D. Select the depth of cut to be employed
3	Use G-Codes and M-Codes to write part program by understanding its structure	<ul style="list-style-type: none"> A. Identify the preparatory and miscellaneous functions of CNC B. Understand the meanings of various G-Codes and M-Codes C. Understand interpolation D. Understand the block numbers E. Understand various steps in the program
4	Practice with Simulation software	<ul style="list-style-type: none"> A. Understand the concept of simulation B. Practice the setting of software in simulation mode C. Open an existing part program D. Practice simulation for the program
6	Simple facing and turning operations	<ul style="list-style-type: none"> A. Write a part program to produce a part for Simple Facing operation. B. Write a part program to produce a part for Simple Turning operation. C. Write a part program to produce a part for Simple Taper turning operation. D. Write a part program to produce a part for Simple step turning operation.
7	Practice step turning canned cycle (Turning exercise)	<ul style="list-style-type: none"> A. Understand the canned cycle B. Write a part program to produce the part as per the given drawing C. Enter the program in the software D. Fix the job and set the tool E. Select proper cutting speed, depth of cut and feed for the given job F. Simulate the program and edit if necessary G. Execute the part program

9	Practice Turning exercise – Taper turning and Peck drilling Thread cutting and grooving	<p>A. Select proper values of cutting speeds and feeds for taper turning and peck drilling</p> <p>A. Select proper values of cutting speeds and feeds for Thread cutting and grooving</p> <p>B. Write part program for Thread cutting and grooving cycles as per the given drawing</p> <p>B.</p>
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18M506P

BOARD DIPLOMA EXAMINATIONS
Model Paper- CAM LAB
Mid Sem-I (CIE)

Time : 1 Hour

Total Marks : 20 M

PART – A

Marks: 4 X 5M = 20 M

*NOTE: Answer **any Four** questions and each question **Five** marks.*

1. Compare manual and computer aided part programming.
2. Define interpolation and types of interpolation
3. Write short notes on (a) Macros (b) Canned Cycles (c) APT.
4. Explain about coordinate systems and reference points in CNC Machines.
5. What are the types of statements used in APT programming and explain them.
6. What are preparatory and miscellaneous functions give examples each?

18M506P

BOARD DIPLOMA EXAMINATIONS
CAM LAB
Mid Sem-II (CIE)

Time : 1 Hour

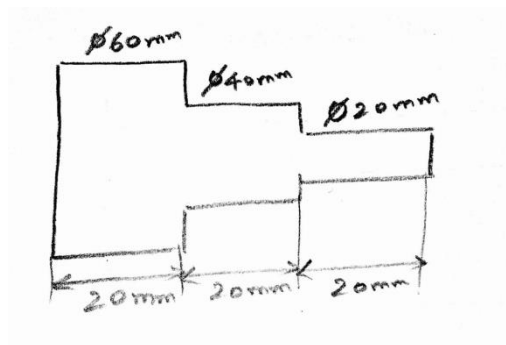
Total Marks : 20 M

PART – A

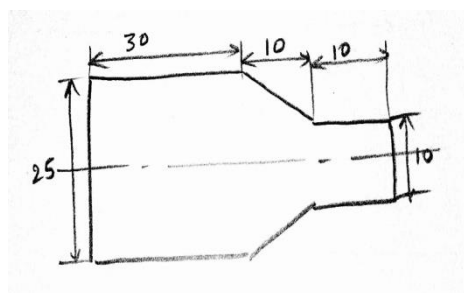
Marks: 2 X 10M = 20 M

NOTE: Answer **any two** questions and each question **10** marks.

1. Write a Program to reduce a billet of size 50X30mm by turning to a size of 40X28mm. maximum depth of cut allowed 2mm.
2. Write a program on manual facing to reduce into 25mm dia 70 mm length rod into 25mm dia 65mm length. maximum depth of cut allowed 1.5mm.
3. Write a program using G codes and M codes to reduce a billet of dia 60mm to dia 20mm in a step of 20mm



4. Write a program using G codes and M codes with dimensions given below



BOARD DIPLOMA EXAMINATIONS
Model Paper - (SEE)
CAM LAB

Time : 2 Hours

Total Marks : 40 M

PART – A

Marks: 2 X

20M = 40 M

*NOTE: Answer **any two** questions and each question **10** marks.*

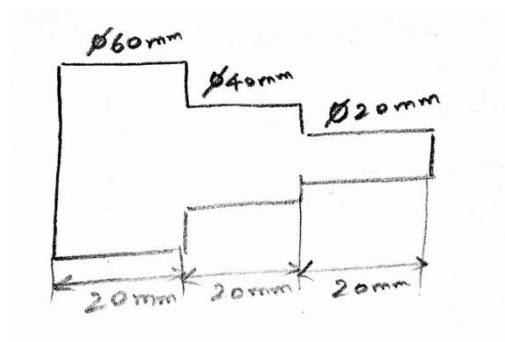
1. Write a Program to reduce a billet of size 50X30mm by turning to a size of 42X25mm. maximum depth of cut allowed 2mm.

2. Write a program and execute on a CNC machine on manual facing to reduce into 25mm dia 70 mm length

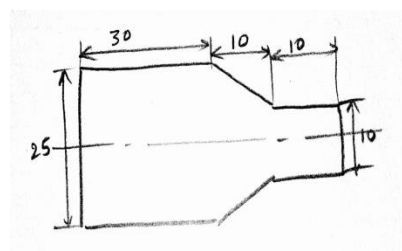
rod into 25mm dia 68mm length and write the precautions taken.

3. Write a program using G codes and M codes and execute on a CNC machine to reduce a billet of dia 60mm

to dia 20mm in a step of 20mm and write the precautions taken.



4. Write a program using G codes and M codes and execute on a CNC machine with dimensions given below and write the precautions taken.



**18M507P, ADVANCED MANUFACTURING & FABRICATION ENGINEERING
LAB**

Course Title :	ADVANCED MFE LAB	Course Code	18M507P
Semester	V	Course Group	: Practical
Teaching Scheme in Periods(L:T:P)	15:00:30	Credits	: 1.5
Methodology	Lecture + Practical	Total Contact Periods:	:45
CIE	60 Marks	SEE	40 Marks

Pre requisites

This course requires the knowledge in basic manufacturing technology

Course Content and Blue Print of Marks for SEE

Unit No	Unit name	Hours/ Periods	Marks for SEE			Marks weightage	%Weightage
			Handling	Manipulation	Precision		
1.	Practice on Lathe machine	09	10	15	15	40	100
2	Practice on milling machine	09	10	15	15	40	100
3	Practice on shaping/planing	06	10	15	15	40	100
4	Practice on slotting machine	03	10	15	15	40	100
5.	Practice on Radial drilling machine	06	10	15	15	40	100
6.	Hands on practice in welding	06	10	15	15	40	100
7.	Servicing and Maintenance	06	10	15	15	40	100
	Total	45	10	15	15	40	100

Course outcomes

Course Outcome	
CO1	Skill in operating a lathe machine and performing lathe operations
CO2	Skill in operating milling machine

CO3	Skill on operating slotting, shaping machine
CO4	Skill on operating drilling machine
CO5	Skill in doing welding operations
CO6	Knowing the importance of servicing and maintenance and importance of maintenance schedules

COURSE CONTENT

I. Machine shop

1. Turning

- a. Thread cutting
- b. Eccentric turning.
- c. Male and female fit assembly

2. Milling / Shaping / Slotting / Planning

- a. Gear Cutting on Milling Machine
- b. T-slot cutting on milling machine
- c. Produce V-Block on shaping machine
- d. Key way cutting Slotting Machines
- e. Practice on Planning machines

3. Drilling

- a. Drilling
- b. Counter boring and counter sinking
- c. Internal threading

II. Welding

- a. T. Joint
- b. H – Joints
- c. Angular joints.
- d. Fabrication of any house hold item like stool, shoe rack etc.,

III. Servicing and Maintenance

- a. Servicing of Lathe tail stock
- b. Servicing of Chuck
- c. Servicing of a machine like drilling or grinding etc.

SPECIFIC LEARNING OUTCOMES

Up on the completion of the course the student shall able to Practice the operations on the Lathe.

- Calculate the gear ratio for thread cutting.
- Cut threads on a lathe machine.

- Produce articles of industrial application such as snap gauges, plug gauges, handle etc.
- Perform the combination of operations to produce jobs.
- Perform special turning operations to produce threaded objects, eccentric turning, and male and female fit assembly

Understand various operations in machine shop

- Perform Cutting operation of V-block on shaping machine.
- Practice the cutting operation on slotter
- Practice the cutting operation on planer
- Practice the principle of indexing on milling machine.
- Perform gear Cutting and key way cutting operation on milling machine

Practice the joining operations in Welding.

- Perform edge preparation and Weld the pieces to prepare T, H, and angular joints.
- Produce utility articles such as shoe rack, garden chair, wash basins, stools etc

Understand various operations of Drilling machine

- Perform various operation of Drilling machine like Drilling, Boring, counter bore, Counter sink and Tapping.

Understand various activities in servicing and maintenance

- Use the testing and inspection methods of machine tools.
- Dismantle and assemble the tailstock and chuck of lathe machine
- Recondition the parts.
- Service and overhaul machine of general nature.
- Prepare maintenance schedules and estimates.

Key Competencies to be acquired by Students

S.No	Exercise	Key competency
Machine shop		
Turning		
1	Thread cutting	a. Center the job with dial gauge b. Fix the cutting tool in suitable angle c. Turn the component with suitable speed and feed d. Cut the threads with back gear arrangements
2	Eccentric turning	a. Fix the job in a chuck with correct eccentricity b. Fix the cutting tool in correct position c. Cut the metal with suitable speed and feed
3	Male and female fit assembly	a. Center the job with dial gauge b. Fix the cutting tool in suitable angle c. Turn the component with suitable speed and feed d. Locate the center of hole e. Select suitable drill bit f. Drill the hole with suitable speed and feed g. Enlarge the hole to suitable diameter by using boring tool
Milling/slotting/planning		
1.	V-block on shaping machine.	a. Fix the job on shaping machine table b. Set the tool and give the table feed c. Set the stroke of the ram
2.	Key way cutting by slotting machine	d. Fix the job on slotting machine table e. Set the tool and give the table feed f. Set the stroke of the ram
3.	Indexing on slotting / milling machine	a. Identify of suitable indexing method b. Calculate revolutions of indexing crank c. Select index plate d. Select of hole circle
4.	T-slot cutting on milling machine	a. Identify T-slot cutter b. Exact setting of work-tool location
5.	Spur gear cutting on milling machine	a. Calculate no. of teeth on meshing gears for compound indexing b. Identify suitable HOB c. Select suitable holder for bevel gear blank
Drilling		
1	Drilling , Boring, Counter bore, Counter sink and Internal Threading	a. Fix the job on table with help of Vice/ T-Bolts b. Estimate the RPM and Feed c. Perform various operations d. To remove the drill bit from spindle with help of drift

Welding		
1	T-Joints, H- Joints, Angular Joints	<ul style="list-style-type: none"> a. Perform edge preparation b. Hold the electrode at suitable angle c. Identify the suitable Method of welding technique. d. Maintain proper distance between work piece and electrode tip produce arc. e. Check the weld bead
Servicing and Maintenance		
1	Tail stock and Chuck	<ul style="list-style-type: none"> f. Select the suitable tools with specification for dismantling. g. Dismantle the tail stock/ chuck h. Understand the operation of each part i. Know the cleaning and lubrication of parts j. Reassemble the tail stock/ chuck

CO-PO MATRIX

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	Mapping Pos
18M507P.1	3	3	3	3	1	--		--	-	1	1,2,3,4,5,10
18M507P.2	3	3	3	3	1	--		--	-	1	1,2,3,4,5,10
18M507P.3	3	3	3	3	1	--		--	-	1	1,2,3,4,5,10
18M507P.4	3	3	3	3	1	--		--	-	1	1,2,3,4,5,10
18M507P.5	3	3	3	3	1	--		--	-	1	1,2,3,4,5,10
18M507P.6	3	3	3	3	1	--		--	-	1	1,2,3,4,5,10

18M507P

BOARD DIPLOMA EXAMINATIONS (C18)

Model Paper

Mid Sem-I

ADVANCED MANUFACTURING & FABRICATION ENGINEERING LAB

Time : 1 Hour

Total Marks : 20 M

Note: Answer any one question.

1. Cut a V thread on the given MS bar with given pitch
2. Prepare a male female assembly as per the given figure.
3. Prepare a eccentric turning as per the given figure.
4. Prepare a T- joint as per the given figure.
5. Prepare a H- joint as per the given figure.
6. Prepare V Block on shaper
7. Prepare Spur gear on milling machine of given pitch.
8. Dismantle the tail stock and reassemble after proper servicing
9. Dismantle the chuck and reassemble after proper servicing
10. Prepare a angular joint as per the given figure

Note: Marks are to be awarded only for conduct of experiment only

18M507P

BOARD DIPLOMA EXAMINATIONS (C18)

Model Paper

Mid Sem-II

ADVANCED MANUFACTURING & FABRICATION ENGINEERING LAB

Time : 1 Hour

Total Marks : 20 M

Note: Answer any one question.

1. Cut a V thread on the given MS bar with given pitch
2. Prepare a male female assembly as per the given figure.
3. Prepare a eccentric turning as per the given figure.
4. Prepare a T- joint with proper edge preparation as per the given figure.
5. Prepare a H- joint with proper edge preparation as per the given figure.
6. Prepare V Block on shaper
7. Prepare Spur gear on milling machine of given pitch.
8. Prepare a angular joint as per the given figure
9. Dismantle the tail stock and reassemble after proper servicing
10. Dismantle the chuck and reassemble after proper servicing

Note: Marks are to be awarded only for conduct of experiment only

18M507P

BOARD DIPLOMA EXAMINATIONS (C18)

Model Paper

Semester End Examination (SEE)

ADVANCED MANUFACTURING & FABRICATION ENGINEERING LAB

TIME : 2 Hours

Max. Marks: 40

1. Cut a LH V thread on the given MS bar with given pitch
2. Prepare a male female assembly as per the given figure.
3. Prepare a eccentric turning as per the given figure.
4. Prepare a pot stand as per the given figure.
5. Prepare a shoe rack as per the given figure.
6. Prepare V Block on shaper
7. Prepare Spur gear on milling machine of given pitch.
8. Dismantle the tail stock and reassemble after proper servicing
9. Dismantle the chuck and reassemble after proper servicing
10. Prepare a stool as per the given figure.

Note: marks are to be awarded for conduct of Experiment, writing of procedure and viva voce

REFRIGERATION AND AIR CONDITIONING LAB

Course Title : Refrigeration and Air Conditioning Lab	Course Code : 18M508P
Semester : V	Course Group : Practical
Teaching Scheme in Periods (L:T:P:) : 15:0:30	Credits : 1.5
Methodology : Tutorial + Practical	Total contact periods : 45
CIE : 60 marks	SEE : 40 marks

Prerequisites: Basic knowledge of Thermodynamics and Refrigeration & Air conditioning

COURSE OUTCOMES

CO1	Familiarize with R&AC tools and basic operations on soft copper tube
CO2	Identify and acquire knowledge on working of different parts of Refrigeration and Air conditioning systems.
CO3	Develop knowledge on refrigerants.
CO4	Calculate COP of R&AC system with given data and use P-H chart.
CO5	Experimentally determine COP of R&AC systems.
CO6	Acquire knowledge on working of air cooler, water cooler, domestic refrigerator, split air conditioner and window air conditioner.

Course Content and Blue Print of Marks for SEE

	Unit name	Hours/ Periods	Marks for SEE			Marks weightage	% Weightage
			Hand ling	Mani pulat ion	Prec ision		
1.	R&AC Tools, Basic Operations on soft Copper tube	6	10	15	15	40	100
2.	Vapour Compression cycle test rig	6	10	15	15	40	100
3.	water cooler	6	10	15	15	40	100
4	air conditioning test rig	6	10	15	15	40	100
5	domestic refrigerator	6	10	15	15	40	100
6	window air conditioner	6	10	15	15	40	100
7	split air conditioner	6	10	15	15	40	100
8	air cooler	3	10	15	15	40	100
	TOTAL	45					

COURSE CONTENT

S. No	Refrigeration and air conditioning lab practice	Number of Periods
1	Familiarisation with R&AC Tools, Basic Operations on soft Copper tube	06
2	Experimental determination of COP of Vapour Compression cycle test rig	06
3	Experimentally determine COP of water cooler	06
4	Experimentally determine COP of air conditioning test rig	06
5	Experimentally determine COP of domestic refrigerator	06
6	Study of a window air conditioner	06
7	Study of a split air conditioner	06
8	Study of air cooler	03
Total		45

SUGGESTED LEARNING OUTCOMES

S.No	Exercise	Key competency
1	Familiarisation with R&AC Tools Basic Operations on soft Copper tube	a. Identify basic tools used in R&AC b. Use the tools to perform flaring, swaging, bending and brazing operations
2	Experimental determination of COP of Vapour Compression cycle test rig	a. Identify the components of vapour compression cycle test rig and draw line diagram b. Know the refrigerant used, its chemical formula and capacity of the plant c. Record the values of pressure and temperature when the pressure gauges are stabilized d. Record the energy meter reading e. Read the values from Pressure Vs Enthalpy diagram of the given refrigerant f. Evaluate COP

3	Study of water cooler and determine COP	<ul style="list-style-type: none"> a. Identify the components of water cooler and draw line diagram b. Know the refrigerant used, its chemical formula and capacity of the plant c. Record the mass and initial and final temperature of water d. Record the energy meter reading e. Evaluate COP (N/W)
4	Experimentally determine COP of air conditioning test rig	<ul style="list-style-type: none"> a. Identify the components of given vapour compression air-conditioning test rig. b. Insert thermometers in suction line and discharge line c. Run the given V.C. A.C. system for some time d. Record the pressure and temperature readings when the pressure gauges are stabilized. e. Record the energy meter reading f. Read the enthalpy values from Pressure Vs Enthalpy diagram of the given refrigerant g. Evaluate COP
5	Study of domestic refrigerator and determine COP	<ul style="list-style-type: none"> a. Identify the components of domestic refrigerator and draw line diagram b. Record the mass and initial and final temperature of water c. Record the energy meter reading d. Evaluate COP (N/W)
6	Study of a window air conditioner	<ul style="list-style-type: none"> a. Identify the components of window air conditioner and draw line diagram b. Know the refrigerant used, its chemical formula and capacity of the window air conditioner
7	Study of a split air conditioner	<ul style="list-style-type: none"> a. Identify the indoor unit and out door unit. b. Identify the components of split air conditioner and draw line diagram c. Know the refrigerant used, its chemical formula and capacity of the window air conditioner

8.	Study of air cooler	a. Identify the components of air cooler and draw line diagram b. Record the values of temperature of the room before and after switching on air cooler.
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CO-PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	Mapping Pos
18M508P.1	-	3	3	-	-	-	-	-	-	-	PO2, PO3
18M508P.2	-	3	3	-	-	-	-	-	-	-	PO2, PO3
18M508P.3	-	3	3	-	-	-	-	-	-	-	PO2, PO3
18M508P.4	-	3	3	-	2	3	2	-	-	-	PO2, PO3,PO5,PO6,PO7
18M508P.5	3	3	3	-	-	-	-	-	-	-	PO1,PO2, PO3
18M508P.6	3	3	3	-	-	-	-	-	-	-	PO1,PO2, PO3

SEE Question paper has to be prepared combined by Internal and External Examiners.

BOARD DIPLOMA EXAMINATIONS (C18)

Model Paper MID SEM - I

DME V SEMESTER EXAMINATION

REFRIGERATION AND AIR CONDITIONING LAB

TIME : 1 Hour

Max. Marks: 20

Answer any one question

1. List all basic tools used in R&AC and identify them and perform flaring and swaging operation on copper tube.
2. List all basic tools used in R&AC and identify them and perform brazing operation on given copper tube.
3. Determine COP of Vapour compression refrigeration cycle from given data numerically
4. Determine COP of Vapour compression refrigeration cycle from given data using p-h chart.
5. Identify all parts of water cooler and explain their function.
6. Determine COP of air conditioning test rig from given data numerically
7. Identify all parts of Domestic refrigerator and explain their function.
8. Identify all parts of split air conditioner and explain their function.

BOARD DIPLOMA EXAMINATIONS (C18)

Model Paper MID SEM - II

DME V SEMESTER EXAMINATION

REFRIGERATION AND AIR CONDITIONING LAB

TIME : 1 Hour

Max. Marks: 20

Answer any one question

1. List all basic tools used in R&AC and identify them and perform flaring and swaging operation on copper tube.
2. List all basic tools used in R&AC and identify them and perform brazing operation on given copper tube.
3. Determine COP of Vapour compression refrigeration cycle from given data numerically
4. Determine COP of Vapour compression refrigeration cycle from given data using p-h chart.
5. Identify all parts of water cooler and explain their function.
6. Determine COP of air conditioning test rig from given data numerically
7. Identify all parts of Domestic refrigerator and explain their function.
8. Identify all parts of split air conditioner and explain their function.

BOARD DIPLOMA EXAMINATIONS (C18)
Model Paper (SEE)
DME V SEMESTER EXAMINATION
REFRIGERATION AND AIR CONDITIONING LAB

TIME : 2 Hours

Max. Marks: 40

Answer any one question

1. List out all basic tools use in RAC. Identify the tools and perform flaring and swaging operation on copper tube
2. List out all basic tools use in RAC. Identify the tools and perform brazing and swaging operation on copper tube
3. Determine COP of Vapour compression cycle from given data numerically
4. Determine COP of Vapour compression cycle from given data using p-h chart.
5. Determine COP of Vapour compression cycle from experimental data
6. Determine COP of water cooler from experimental data.
7. Determine COP of domestic refrigerator from experimental data.
8. Determine COP of air conditioning test rig from experimental data.
9. Identify all major parts of window air conditioner and explain their function.
10. Identify all major parts of split air conditioner and explain their function.
11. Identify all major parts of window air conditioner and explain their function, record the change in temperature of room for every 5 minutes.

PROGRAMMING IN C LAB PRACTICE

Course Title:	Programming in C lab practice	Course Code	18M509P
Semester	V	Course Group	practical
Teaching Scheme in Periods(L: T:P)	15:00:30	Credits	1.5
Methodology	Lecture + Practical	Total Contact periods:	45Pds
CIE	60 Marks	SEE	40 Marks

Pre requisites

Basic knowledge of Computer Operation.

Course outcomes

Course Outcome	
CO1	Write programs using input/output statements, variables and operators
CO2	Work on Constants, Variables, Data Types, Operators and Expressions in C
CO3	Construct programs on Decision making and Looping statements.
CO4	Develop programs using arrays and structures

Course Content

1. Programming Methodology and Introduction to C Language Duration: 5 Periods

Program - Define High level language and low level language-history of C language - importance of C language – Define & Differentiate Compiler, Assembler - structure of C language - programming style of C language - steps involved in executing the C program

2. Understand Constants, Variables and Data Types in C and Understand Operators and Expressions in C Duration: 15 Periods

Character set - C Tokens - Keywords and Identifiers- Constants and Variables - data types and classification - declaration of a variable - Assigning values to variables - Define an operator - Define an expression -Classify operators - List and explain various arithmetic operators with examples -Illustrate the concept of relational operators - List logical operators - various assignment operators - Increment and decrement operators - Conditional operator - List bitwise operators -List various special operators- Arithmetic expressions- precedence and associativity of operators- Evaluation of expressions - formatted input and output.

3. Decision making and Looping statements

Duration: 10

Periods

Simple if statement with sample program – if else statement – else if statement – switch statement -Classification of various loop statements- while statement – do-while statement - for loop statement - break and continue statements.

4. Arrays and Structures

Duration:

15 Periods

Arrays -declaration and initialization of One Dimensional -Accessing elements in the Array - Declaration and initialization of two Dimensional Arrays - sample programs on matrix addition and matrix multiplication–Declaration of a Structure – Structure members – Array of structures.

Course Outcome		CL	Linked PO	Teaching Hours
CO1	Write programs using input/output statements, variables and operators	R, U, A	1,2,3,4,8,9,10	5
CO2	Work on Constants, Variables, Data Types, Operators and Expressions in C	R, U, A	1,2,3,4,8,9,10	15
CO3	Construct programs on Decision making and Looping statements.	R,U, A	1,2,3,4,8,9,10	10
CO4	Develop programs using arrays and structures	U, A	1,2,3,4,8,9,10	15
			Total Sessions	45

REFERENCE BOOKS

1. Let Us C -- Yeshwanth Kanetkar BPB Publications
2. Programming in ANSI C -- E. Balaguruswamy Tata McGrawHill
3. Programming with C -- Gottfried Schaum's outline
4. C The complete Reference -- Schildt Tata McGraw Hill

List of Experiments

1. Exercise on structure of C program
2. Exercise on Keywords and identifiers
3. Exercise on constants and variables
4. Execution of simple C program
5. Exercise on operators and expressions
6. Exercise on special operators

7. Exercise on input and output of characters
8. Exercise on formatted input and output
9. Exercise on simple if statement
10. Exercise on ifelse statement
11. Exercise on elseif ladder statement
12. Exercise on switch statement
13. Exercise on conditional operator
14. Exercise on while statement
15. Exercise on for statement
16. Exercise on do...while statement
17. Exercise on one dimensional arrays
18. Exercise on two dimensional arrays
19. Exercise on structure
20. Exercise on array of structures

Department of Technical education
State Board of Technical education & Training (TS)
Project Work

Course title:	Project work			Course Code:	18M510P
				Course group:	practical
Semester:	V			Credits:	1.5
Teaching scheme in periods (L:T:P):	15:00:30			Total contact periods :	45
Methodology: Lecturer+ Assignment:					
CIE:	60 Marks			SEE:	40 Marks

Course out comes:

The student should be able to

1. Apply principles of Mechanical engineering and Knowledge to solve problems of component with mechanical bias.
2. Demonstrate the knowledge to assess safety, legal issues and consequent responsibilities
3. To function effectively as an individual and as a member in a team
4. To communicate effectively
5. To engage in lifelong learning in the context of technological changes

V SEMESTER

Sl. No	Subject	Items	Max Marks
1	Project work	CIE	
		1. Mid - I: Abstract submission – (Marks awarded by the Guide)	20
		2. Mid – II: Content development/ literature survey, data collection/prototype etc. - (Marks awarded by the Guide)	20
		3.Internal evaluation - (Marks awarded by the Guide)	20
		SEE	
		4.a) Final report Submission b) Seminar /Viva Voce (Marks awarded by the External Examiner, Head of Section (i.e. Internal Examiner) and Guide).	20 20
		Total	
			100

Note: The Project work carries 100 marks and pass marks are 50% and minimum of 50% in SEE. Internal assessment is done by guide and external assessment is conducted by guide, head of section and external examiner.

A candidate failing to secure the minimum marks has to reappear for the project.

COURSE CONTENT

- Identification and selection of a product with an aim to setup a small-scale industry.
- Conduct of detailed market survey.
- Preparation of production drawings.
- List of the raw materials, equipment and tools needed for manufacturing a specified quantity.
- Development of a prototype model of the product in workshop (if possible) with the available facilities in the Polytechnics.
- Exploration of the various financial arrangements to start the manufacturing of the product under technocrat scheme in small scale industrial sector.
- Detailed survey of requirements of the department of industry, municipal, health inspectorate of factories, electrical inspectorate, banks, other financial agencies etc., for starting an industry.
- Planning for type of organisation.
- Selection of site.
- Preparation of techno feasibility report consisting of production drawings, plant layout, building requirements, equipment requirement, list of raw materials and their availability, tools and other items, labour force requirement for production, ministerial staff requirement, material flow sheet, cash flow sheet, financial analysis etc.
- Working models, repairs, up gradation and maintenance of equipment.
- Product selection may be done by the Polytechnic in consultation with the local industries and other agencies.
- The student should submit techno feasibility report or model on a product selected with an aim to set up an industry in small scale sector.

Suggested learning outcomes

Upon completion of the course the student shall be able to

- **Prepare technical project report**

- Identify component with mechanical bias.
 - Design and draw the production drawings.
 - Prepare a project report with details of materials, processes etc.
 - Develop a proto type/model of the product with the facilities available in polytechnic.
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- **Conduct survey to establish a small scale unit**
 - Identify and select a product with an aim to set up a small scale industry.
 - Conduct a detailed market survey.
 - List the raw materials, equipment and tools needed for the manufacture of a specified quantity.
 - Explore the various financial arrangements to start the manufacture of a product under technocrat scheme in small scale industrial sector.
 - Make a survey of requirements of the department of industries, municipal, health, inspectorate of factories for starting an industry.
 - Plan for a type of organisation.
 - Select a site.
 - Prepare a techno feasibility report consisting of drawings, plant layouts, building requirements, machinery and equipment requirements, raw material, labour, production and administrative staff requirements, working capital, material flow sheet, cash flow sheet, financial analysis etc.
 - Develop working models to show scientific and engineering principles studied in the curriculum and repair, up gradation and maintenance of equipment which are exist.

CO-PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	Mapping Pos
1	3	3	2	2	1	2	1	3	2	2	all
2	3	3	1		3	3			1		1,2,3,5,6,9
3	3	3	1					3	1		1,2,3,8,9
4	3	3							3	2	1,2,9,10
5	3	3	3	3	1	1	1		3	3	1,2,3,4,5,6,7,9,10

RUBRICS 1: Mid Sem - I

	GOOD	AVERAGE	ACCEPTABLE	UNACCEPTABLE
Identification of problem	Good explanation of the purpose and need of the project	average explanation of the purpose and need of the project	Moderate explanation of the purpose and need of the project	Minimal explanation of the purpose and need of the project
Study the existing systems	Collects a great deal of information and good study of the existing systems	Collects some basic information	Limited information	Incomplete information
Objectives and methodology	Good justification to the objectives	Incomplete justification to the objectives	Only some objectives of the proposed	Objectives of the proposed work are either not identified or not well

1. Identification of problem and explanation of the purpose and need of the project

2. Detailed study of the existing systems and feasibility of project proposal

3. Methodology and Abstract submission

RUBRICS2: Mid Sem II

	GOOD	AVERAGE	ACCEPTABLE	UNACCEPTABLE
Incorporation of suggestions	Changes are made as per modification	All changes are made as per modification	Few changes are made	Suggestions are not incorporated
Project demonstration	All defined objectives are	All modules are achieved	Some of the defined	Defined objectives are not achieved

	achieved		objectives are achieved	
Demonstration and presentation	Objectives achieved as per time frame	Objectives achieved as per time frame	Objectives achieved as per time frame	No Objectives achieved as per time frame

1. Changes are made as per modifications suggested and new innovations added
2. Complete explanation of the key concepts strong description of the technical requirements of the project
3. Objectives achieved as per time frame

SKILL UPGRADATION IN V SEMESTER

Course Title : Skill Upgradation	Course Code : -
Semester : V	Course Group : Practical
Teaching Scheme in Periods (L:T:P:) : 0:70:35	Credits : 2.5
Methodology : Practicals	Total contact periods : 105

1. Prepare an organisational structure of institution
2. A Case study on principles of management.
3. Make a survey on marketing a product.
4. Prepare a list of ISO 9000 series as well as latest quality standards
5. Prepare sign boards representing safety measures.
6. Role play as an entrepreneur
7. A Case study on work study measurement.
8. Prepare job specifications and job description for a specific job.
9. Compare various job evaluation methods for a real example.
10. Calculate earnings of workers using various wage differentials
11. Prepare a cost statement using Excel sheet for real time problem.
12. Prepare an Excel sheet for fabrication data tables.
13. Study movement of cam and draw cam profile.
14. Design a open belt drive for a simple application.
15. List out common bearings and the material used ,
16. Visit nearest outlet and list out Domestic Refrigerators manufacturers and know the capacity of the refrigerator and the refrigerant used in it.
17. Know the colour coding of refrigerant cylinders.
18. Make a report of Montreal and Kyoto protocols.
19. Assemble and disassemble the air cooler and know all the parts.
20. Clean an air cooler, replace pads of air cooler.
21. Visit a RAC workshop and watch the method of vaccumisation and charging of refrigerant.
22. Visit a duct manufacturing unit and study how fabrication is done and submit a report.
23. Visit a site where ducting is being carried out.
24. Collect data sheet to find heating and cooling loads for an air conditioning system and study its contents.
25. Visit a site where split air conditioner is being installed.
26. Visit a central air conditioning plant.