

**RATIOANLE**

A diploma holder in this course is supposed to know about testing of IC Engines, fuel supply, ignition system, cooling and lubrication of engines and gas turbines. Hence this subject

**DETAILED CONTENTS****UNIT 1**

IC Engines

- 1.1 Introduction
- 1.2 Working principle of two stroke and four stroke cycle, SI engines and CI engines, Otto cycle, diesel cycle and dual cycle
- 1.3 Location and functions of various parts of IC engines and materials used for them

**UNIT 2**

Fuel Supply and Ignition System in Petrol Engine

- 2.1 Concept of carburetion
- 2.2 Air fuel ratio
- 2.3 Simple carburetor and its application, MPFI, Common rail system, super charging and turbo charger
- 2.4 Description of battery coil and magneto ignition system, fault finding and remedial action in ignition system

Fuel System of Diesel Engine

- 2.5 Components of fuel system
- 2.6 Description and working of fuel feed pump
- 2.7 Fuel injection pump
- 2.8 Injectors

**UNIT 3**

Cooling and Lubrication

- 3.1 Function of cooling system in IC engine
- 3.2 Air cooling and water cooling system, use of thermostat, radiator and forced

circulation in water cooling (description with line diagram)

- 3.2 Function of lubrication
- 3.3 Types and properties of lubricant
- 3.4 Lubrication system of engine
- 3.5 Fault finding in cooling and lubrication and remedial action

Testing of IC Engines

- 3.6 Engine power - indicated and brake power
- 3.7 Efficiency - mechanical, thermal, relative and volumetric
- 3.8 Methods of finding indicated and brake power
- 3.9 Morse test for petrol engine
- 3.10 Heat balance sheet
- 3.11 Concept of pollutants in SI and CI engines, pollution control, norms for two or four wheelers - EURO - 1, EURO - 2, methods of reducing pollution in IC engines, alternative fuels like CNG, LPG, Hydrogen

#### **UNIT 4**

Steam Turbines and Steam Condensers

Function and use of steam turbine

- 4.1 Steam nozzles - types and applications
- 4.2 Steam turbines - impulse, reaction, simple and compound, construction and working principle
- 4.3 Governing of steam turbines
- 4.4 Function of a steam condenser, elements of condensing plant
- 4.5 Classification - jet condenser, surface condenser
- 4.6 Cooling pond and cooling towers

#### **UNIT 5**

Gas Turbines and Jet Propulsion

- 5.1 Classification, open cycle gas turbine and closed cycle gas turbine, comparison of gas turbines with reciprocating IC engines, applications and limitations of gas turbine
- 5.2 Open cycle constant pressure gas turbines - general layout, PV and TS diagram and working of gas turbine
- 5.3 Closed cycle gas turbines, PV and TS diagram and working
- 5.4 Principle of operation of ram-jet engine and turbo jet engine - application of jet engines

5.5 Rocket engine - its principle of working and applications

5.6 Fuels used in jet propulsion

### **INSTRUCTIONAL STRATEGY**

1. Use computer based learning aids for effective teaching-learning
2. Expose students to real life problems
3. Plan assignments so as to promote problem solving abilities and develop continued learning skills

### **RECOMMENDED BOOKS**

1. Elements of Heat Engines by Pandey and Shah; Charotar Publishing House, Anand.
2. Thermal Engineering by PL. Ballaney; Khanna Publishers, New Delhi.
3. Engineering Thermodynamics by Francis F Huang; McMillan Publishing Company, Delhi.
4. Engineering Thermodynamics by CP. Arora; Tata McGraw Hill Publishers, New Delhi.
5. Thermal Engineering by RK Purohit; Standard Publishers Distributors, New Delhi.

**LIST OF PRACTICALS**

1. Dismantle a two stroke engine, note the function and material of each part, reassemble the engine.
2. Dismantle a single cylinder diesel engine. Note the function of each part, reassemble the engine.
3. Study of battery ignition system of a multi-cylinder petrol engine stressing ignition timings, setting, fixing order and contact breaker; gap adjustment.
4. Study of cooling of IC engine.
5. Study of lubricating system of IC engine.
6. Determination of BHP by dynamometer.
7. Morse test on multi-cylinder petrol engine.
8. Local visit to roadways or private automobile workshops.
9. Study of steam turbines through models and visit.
10. Study of steam condensers through model and visits.

**RATIONALE**

Diploma holders in this course are required to analyze reasons for failure of different components and select the required material for different applications. For this purpose, it is essential to teach them concepts, principles, applications and practices covering stress, strain, bending moment, shearing force, shafts, columns and springs. It is expected that efforts will be made to provide appropriate learning experiences in the use of basic principles in the solution of applied problems to develop the required competencies.

**DETAILED CONTENTS****UNIT 1****Stresses and Strains**

- 1.1. Concept of load, stresses and strain
- 1.2. Tensile compressive and shear stresses and strains
- 1.3. Concept of Elasticity, Elastic limit and limit of proportionality.
  - 1.3.1. Hook's Law
  - 1.3.2. Young Modulus of elasticity
  - 1.3.3. Nominal stress
  - 1.3.4. Yield point, plastic stage
  - 1.3.5. Ultimate strength and breaking stress
  - 1.3.6. Percentage elongation
  - 1.3.7. Proof stress and working stress
  - 1.3.8. Factor of safety
  - 1.3.9. Shear modulus
- 1.4. Longitudinal and circumferential stresses in seamless thin walled cylindrical shells (derivation of these formulae not required)

**UNIT 2****Resilience**

- 2.1 Resilience, proof resilience and modulus of resilience
- 2.2 Strain energy due to direct stresses
- 2.3 Stresses due to gradual, sudden and falling load.

## **Moment of Inertia**

- 2.4. Concept of moment of Inertia and second moment of area
- 2.5. Radius of gyration , section modulus
- 2.6. Theorem of perpendicular axis and parallel axis ( without derivation)
- 2.7. Second moment of area of common geometrical sections: Rectangle, Triangle, Circle (without derivation) Second moment of area for I,T, L, Z section.

## **UNIT 3**

### **Bending Moment and Shearing Force**

- 3.1 Concept of beam and form of loading
- 3.2 Concept of end supports-Roller, hinged and fixed
- 3.3 Concept of bending moment and shearing force
- 3.4 B.M. and S.F. Diagram for cantilever and simply supported beams with and without overhang subjected to concentrated and U.D.L.

### **Bending stresses**

- 3.5 Concept of Bending stresses
- 3.6 Theory of simple bending
- 3.7. Use of the equation  $f/y = M/I = E/R$
- 3.8. Concept of moment of resistance
- 3.9. Bending stress diagram
- 3.10. Calculation of maximum bending stress in beams of rectangular, circular, and T section.
- 3.11 Permissible bending stress Section modulus for rectangular, circular and symmetrical I section.

## **UNIT 4**

### **Columns**

- 4.1. Concept of column, modes of failure
- 4.2. Types of columns
- 4.3. Buckling load, crushing load
- 4.4. Slenderness ratio
- 4.5. Factors effecting strength of a column

- 4.6 End restraints
- 4.7 Effective length
- 4.8 Strength of column by Euler Formula without derivation
- 4.9. Rankine Gourdan formula ( without derivation)

### **Torsion**

- 4.10 Concept of torsion- difference between torque and torsion.
- 4.11 Use of torque equation for circular shaft
- 4.12 Comparison between solid and hollow shaft with regard to their strength and weight.
- 4.13 Power transmitted by shaft
- 4.14 Concept of mean and maximum torque

## **UNIT 5**

### **Springs**

- 5.1. Closed coil helical springs subjected to axial load and impact load
- 5.2 Stress deformation
- 5.3 Stiffness and angle of twist and strain energy
- 5.4 Proof resilience
- 5.5 Laminated spring (semi elliptical type only)
- 5.6 Determination of number of plates

## **INSTRUCTIONAL STRATEGY**

1. Expose the students to real life problems.
2. Plan assignments so as to promote problem solving abilities and develop continued learning skills.

## **RECOMMENDED BOOKS**

1. SOM by Birinder Singh,; Katson Publishing House, New Delhi.
2. SOM by RS Khurmi; S.Chand & Co; New Delhi
3. Elements of SOM by D.R. Malhotra & H.C.Gupta; Satya Prakashan, New Delhi.

**LIST OF PRACTICALS**

1. Tensile test on bars of Mild steel and Aluminium.
2. Bending tests on a steel bar or a wooden beam.
3. Impact test on metals
  - a) Izod test
  - b) Charpy test
4. Torsion test on specimens of different metals for determining modulus of rigidity.
5. To determine the stiffness of a helical spring and to plot a graph between load and extension.
6. Hardness test on different metals.



**RATIONALE**

Diploma holders are responsible for supervising production processes to achieve production targets and for optimal utilization of resources. For this purpose, knowledge about various machining processes, modern machining methods, processing of plastic, tools, jigs and fixtures and processing of plastics is required to be imparted. Hence the subject of workshop technology.

**DETAILED CONTENTS****UNIT 1**

## Cutting Tools and Cutting Materials

- 1.1. Cutting Tools - Various types of single point cutting tools and their uses, Single point cutting tool geometry, tool signature and its effect, Heat produced during cutting and its effect, Cutting speed, feed and depth of cut and their effect
- 1.2 Cutting Tool Materials - Properties of cutting tool material, Study of various cutting tool materials viz. High-speed steel, tungsten carbide, cobalt steel cemented carbides, stellite, ceramics and diamond.

**UNIT 2**

## Lathe

- 2.1 Principle of turning
- 2.2 Description and function of various parts of a lathe
- 2.3 Classification and specification of various types of lathe
- 2.4 Drives and transmission
- 2.5 Work holding devices
- 2.6 Lathe tools: Parameters/Nomenclature and applications
- 2.7 Lathe operations :- Plain and step turning, facing, parting off, taper turning, eccentric turning, drilling, reaming, boring, threading and knurling, form turning, spinning.
- 2.8 Cutting parameters – Speed, feed and depth of cut for various materials and for various operations, machining time.
- 2.9 Speed ratio, preferred numbers of speed selection.
- 2.10 Lathe accessories:- Centers, dogs, different types of chucks, collets, face plate, angle plate, mandrel, steady rest, follower rest, taper turning

attachment, tool post grinder, milling attachment, Quick change device for tools.

- 2.11 Brief description of capstan and turret lathe, comparison of capstan/Turret lathe, work holding and tool guiding devices in capstan and turret lathe.

### **UNIT 3**

Drilling

Principle of drilling.

- 3.1 Classification of drilling machines and their description.
- 3.2 Various operation performed on drilling machine – drilling, spot facing, reaming, boring, counter boring, counter sinking, hole milling, tapping.
- 3.3 Speeds and feeds during drilling, impact of these parameters on drilling, machining time.
- 3.4 Types of drills and their features, nomenclature of a drill
- 3.5 Drill holding devices.
- 3.6 Types of reamers.

Boring

- 3.8 Principle of boring
- 3.9 Classification of boring machines and their brief description.
- 3.10 Specification of boring machines.
- 3.11 Boring tools, boring bars and boring heads.
- 3.12 Description of jig boring machine.

### **UNIT 4**

Shaping, Planing and Slotting

Working principle of shaper, planer and slotter.

- 4.1 Type of shapers
- 4.2 Type of planers
- 4.3 Quick return mechanism applied to shaper, slotter and planer machine.
- 4.4 Work holding devices used on shaper, planer and slotter.
- 4.5 Types of tools used and their geometry.
- 4.6 Specification of shaper, planer and slotting machine.
- 4.7 Speeds and feeds in above processes.

Broaching

- 4.9 Introduction

- 4.10 Types of broaching machines – Single ram and duplex ram horizontal type, vertical type pull up, pull down, push down.
- 4.11 Elements of broach tool, broach tooth details – nomenclature, types, and tool material.

## **UNIT 5**

### Jigs and Fixtures

- 5.1 Importance and use of jigs and fixture
- 5.2 Principle of location
- 5.3 Locating devices
- 5.4 Clamping devices
- 5.5 Types of Jigs – Drilling jigs, bushes, template jigs, plate jig, channel jig, leaf jig.
- 5.6 Fixture for milling, turning, welding, grinding
- 5.7 Advantages of jigs and fixtures

### Cutting Fluids and Lubricants

- 5.8 Function of cutting fluid
- 5.9 Types of cutting fluids
- 5.10 Difference between cutting fluid and lubricant
- 5.11 Selection of cutting fluids for different materials and operations
- 5.12 Common methods of lubrication of machine tools.

## **INSTRUCTIONAL STRATEGY**

1. Teachers should lay emphasis in making students conversant with concepts and principles of manufacturing processes.
2. Focus should be on preparing jobs using various machines in the workshop

## **RECOMMENDED BOOKS**

1. Workshop Technology by B.S. Raghuwanshi; Dhanpat Rai and Sons; Delhi
2. Manufacturing Technology by M. Adithan and A.B. Gupta; New Age International (P) Ltd, Delhi.
3. Elements of Workshop Technology by SK Choudhry and Hajra; Asia Publishing House
4. A Text Book of Production Engineering by PC Sharma; S Chand and Company Ltd. Delhi

**LIST OF PRACTICALS****Turning Shop**

- Job 1. Grinding of single point turning tool.
- Job 2. Exercise of simple turning and step turning.
- Job 3. A composite job involving, turning, taper turning, external thread cutting and knurling.

**Advance Fitting Shop**

- Job 1. Exercise on drilling, reaming, counter boring, counter sinking and tapping
- Job 2. Dove tail fitting in mild steel
- Job 3. Radius fitting in mild steel
- Job 4. Pipe threading with die

**Machine Shop**

- Job 1. Prepare a V-Block up to  $\pm 0.5$  mm accuracy on shaper machine
- Job 2. Exercise on key way cutting and spline cutting on shaper machine.

**RATIONALE**

Metrology is the science of measurement, Diploma holders in this course are responsible for ensuring process and quality control by making measurements and carrying out inspection of various parameters. For this purpose, knowledge and skills about various measuring instruments are required. The aim of this subject is to develop knowledge and skills regarding various measuring instruments amongst the students.

**DETAILED CONTENTS****UNIT 1**

## Introduction

- 1.1 Definition of metrology
- 1.2 Standard of measurement
- 1.3 Types of Errors - Controllable and random errors
- 1.4 Precision, accuracy, sensitivity, hysteresis, response time, repeatability, calibration, uncertainty of measurement, interchangeability.
- 1.5 Standardization and standardizing organizations

**UNIT 2**

## Linear and Angular Measurement

- 2.1 Construction features and use of instruments for non precision linear measurement: steel rule, callipers, surface plate, angle plate, V-block.
- 2.2 Construction features and use of instruments for precision measurements: vernier calipers, vernier height and depth gauges, micrometers.
- 2.3 Slip gauges, Indian standards of slip gauges, sets of slip gauges, use of slip gauges.
- 2.4 Cylinder bore gauges, feeler and wire gauges. Checking flatness, roundness and squareness
- 2.5 Comparators – Characteristics, uses, working principles of different types of comparators: mechanical, electrical, electronics and pneumatic.
- 2.6. Construction and use of instruments for angular measurements: bevel Protector, sine bar, angle gauges, clinometer, angle dekker. Optical instruments for angular measurement, auto collimator.

**UNIT 3**

## Measurement of Surface Finish

- 3.1 Terminology of surface roughness.

- 3.2 Concept of primary texture and secondary texture.
- 3.3 Factors affecting surface finish.
- 3.4 CLA, RMS and RA value.
- 3.5 Principle and operation of stylus probe instruments. Tomlinson surface meter and Taylor surface talysurf.

#### Measurements of Screw threads and Gauges

- 3.6 Measurement of screw threads- Introduction, measurements of external and core diameters, checking of pitch and angle of threads with gauges.
- 3.7 Measurements of gears (spur) – Measurement of tooth thickness, pitch,
- 3.8 Profile projector, Coordinate Measuring Machine (CMM), Tool maker's microscope.

### **UNIT 4**

#### Instrumentation

- 4.1 Various types of instruments used for mechanical quantities such as displacement, velocity, acceleration, speed and torque. Use of transducers and electronic counters, stroboscope, vibrating reeds and tachometers.
- 4.2 Strain gauge – use of strain gauge and load cells

### **UNIT 5**

#### Quality Control

- 5.1 Quality control, SQC, function of quality control, quality cost, factors affecting quality of product.
- 5.2 Inspection need, types of inspection and stages of inspection
- 5.3 Statistical Quality Control – Definition
- 5.4 Process Capability
- 5.5 Introduction to Control Charts(X bar, R,p,c) and their simple applications
- 5.6 Concepts of ISO 9000, ISO 14000
- 5.7 Total Quality Management - QC tools, Kaizan, 5S,

## **INSTRUCTIONAL STRATEGY**

1. Demonstrate use of various measuring instruments while imparting theoretical instructions.
2. Stress should be laid on correct use of various instruments.

## **RECOMMENDED BOOKS**

1. Engineering Metrology by RK Jain; Khanna Publishers, New Delhi.
2. A Text Book of Production Engineering by RC Sharma; S Chand and Company, New Delhi.
3. Metrology Laboratory Manual by M Adithan and R Bahl; NITTTR, Chandigarh.
4. Engineering Metrology by RK Rajput; SK Kataria and Sons, Ludhiana.

**LIST OF PRACTICALS**

1. Internal and external measurements with vernier calliper and microscope
2. Measurement of linear dimensions with height gauge and depth gauge.
3. Measurement of flatness, concentricity with dial indicator
4. Use of feeler gauge, wire gauge, radius gauge and fillet gauges for checking of standard parameters.
5. Use of plain plug and ring gauge, taper plug and ring gauge, thread plug and ring gauge and snap gauges.
6. Measurement of Angle using;
  - i) Cylindrical rollers and spherical balls and slip gauges
  - ii) Bevel protector
  - iii) Sine Bar/Sine Table , Slip Gauges, Height Gauge and dial indicator.
  - iv) Angle deckor.
7. Measurement of spur gear characteristics;
  - i) Measurement over teeth (M.O.T) by using flange/Disc micrometer.
  - ii) P.C.D run-out using bench centre, mandrel, cylindrical pin and dial indicator.
  - iii) Composite error using Gear Roller Tester and Master Gear.
8. Measurement of thread parameters by using tool maker's microscope.
9. Measurement of effective diameter of external threads by 2-wire and 3-wire method.
10. Measurement of cylindrical bore using cylinder bore gauge for bore diameter, ovality and taper.
11. Measurement of worn out IC engine piston clearance between cylinder and piston.
12. Measurement of surface roughness using surface roughness tester.
13. Measurement of co-ordinates of two or more than two holes using surface plate, angle plate, Height Gauge, dial indicator and slip gauges.
14. Measurement of a profile using profile projector.
15. Study and use of Auto-Collimator.



**RATIONALE**

Diploma holders in Mechanical Engineering are required to interpret drawings and therefore it is essential that they have skills of preparing drawings and sketches of mechanical components. This subject aims at development of skills and understanding of mechanical engineering drawings.

**DETAILED CONTENTS****UNIT 1**

## I.C. Engine Parts

- 1.1 Piston
- 1.2 Connecting rod (Assembly drawing)
- 1.3 Crankshaft and flywheel assembly

**UNIT 2**

## Boiler Parts

- 2.1 Steam Stop Valve (Assembled drawing)
- 2.2 Blow off cock. (Assembled drawing)

## Mechanical Screw Jack (Assembled Drawing)

**UNIT 3**

## Cams

- 3.1 Types of cams and followers (Theoretical)
- 3.2 Profile of cams for imparting following motions with knife edge and roller followers.:
  - Uniform motion
  - Simple Harmonic Motion
  - Uniformity accelerated and retarded motion:

**UNIT 4**

## Gears

- 4.1 Nomenclature of gears and conventional representation

4.2 Drawing the actual profile of involute teeth of spur gear by different methods.

## **UNIT 5**

Introduction to CAD Software commands (2D)

- 5.1 Concept of Computer Aided Drafting (CAD), Tool bars in CAD, Software
- 5.2 Drawing commands – point, line, arc, circle, ellipse, polygon
- 5.3 Editing commands – scale, erase, copy, stretch, lengthen and explode, move, array, trim, mirror, chamfer, fillet, rotate
- 5.4 Dimensioning and placing text in drawing area
- 5.5 Sectioning and hatching
- 5.5 Inquiry for different parameters of drawing entity
- 5.6 Concept of layers and working on multiple layers

- Note:
- 1. 1<sup>st</sup> angle projection should be followed. 20% of the drawings may be made using 3<sup>rd</sup> angle projection.
  - 2. SP- 46-1998 should be followed. The drawings should include dimensions with tolerance wherever necessary and material as per BIS/ISO specifications.

## **RECOMMENDED BOOKS**

- 1. Machine Drawing by P.S. Gill; S.K. Kataria & Sons, Ludhiana
- 2. A Text Book of Machine Drawing by RK Dhawan; S.Chand & Co. Ltd., New Delhi.
- 3. Machine drawing by N.D Bhatt, Charotar Book Depot, Anand

## **ENTREPRENEURIAL AWARENESS CAMP**

This is to be organized at a stretch for two to three days during fourth semester. Lectures will be delivered on the following broad topics. There will be no examination for this subject

1. Who is an entrepreneur?
2. Need for entrepreneurship, entrepreneurial career and wage employment
3. Scenario of development of small scale industries in India
4. Entrepreneurial history in India, Indian values and entrepreneurship
5. Assistance from District Industries Centres, Commercial Banks. State Financial Corporations, Small industries Service Institutes, Research and Development Laboratories and other financial and development corporations
6. Considerations for product selection
7. Opportunities for business, service and industrial ventures
8. Learning from Indian experiences in entrepreneurship (Interaction with successful entrepreneurs)
9. Legal aspects of small business
10. Managerial aspects of small business

# ELECTIVE-II (GENERIC)

**RATIONALE**

Entrepreneurship development aim at developing conceptual understanding for setting-up one's own business venture/enterprise. This aspect of Human Resource Development has become equally important in the era, when wage employment prospects have become meager.

**DETAILED CONTENTS****UNIT-1**

Entrepreneurship: concept, characteristics, and prerequisites, classification of entrepreneurship, Entrepreneurial Skills, Factors influencing entrepreneurship, Role of entrepreneurship in economic development, Challenges in starting a new venture.

**UNIT-2**

The entrepreneurial process, Developing ideas and business opportunities- methods of generating new idea, New Product development- stages, writing and presentation of the business plan, Market analysis and Feasibility Planning.

**UNIT-3**

Financing the venture & other support systems- Early stage finances and growth funding, Commercial banks- types of bank loans; District Industry centres (DICs), State Financial Corporations. Small Industries Development Bank of India, National Bank of Agriculture and Rural development (NABARD). How to start a small scale industry (SSI), Procedures for registration of SSI.

**UNIT-4**

Patents, Trademarks and Copyrights- concept and its application in the market, Intellectual property infringement; mergers and acquisition; corporate social responsibility.

**UNIT-5**

Going public: Advantages and Disadvantages. Harvesting the venture and other strategies, Buyout Agreement Negotiation and Time Management.

**RECOMMENDED BOOKS**

1. Agarwal, Vinod K, Initiative enterprise and economic choice in a study of the paters of entrepreneurship. Munshiram Manoharlal, New Delhi.
2. Clifton, Davis S and F Y fir, David E, project feasibility analysis, John Willey, New York.
3. David H Holt, Entrepreneurjrship: New Venture creation, Prentice Hall.
4. Deasi vasant, Entrepreneurial Development, Himalayas publishing house.
5. Druker peter, Innovation and Entrepreneurship, Heinemann London.
6. Kumar S.A, Entgpreneurship in small industry, Discovery Publishers New Delhi.
7. Pareek Vdai and Venkeateshwatra Rao T : Developing Entrepreneurship: A handbook of learning system, New Delhi.

**RATIONALE**

The diploma holders are generally expected to take up middle level managerial positions, their exposure to basic management principles is very essential. Various Topics have been included in the subject to provide elementary knowledge about these management areas

**DETAILED CONTENTS****UNIT 1.**

Introduction: Management, nature, process and significance of Management; Managerial skills; Managerial Roles; Overview of functional areas of management-Marketing, Finance, Production, HRM, IT, Development of managerial Thought. Taylor concept, Henry Fayol, Elton Mayo concept. Contingency approach overview.

**UNIT 2.**

Planning: Concept, Process and Types; concept of Decision making; Decision making process; Factors affecting decision making process; Management by objectives (MBO) & Management by Exception (MBE). Planning-analysis and diagnosis, Strategy formulation.

**UNIT 3**

Organising: Concept, nature, process and Significance; Authority and responsibility relationship- Delegation, Centralisation & Decentralisation; formal and informal organisation structures. Hierarchy and flat structures.

**UNIT 4**

Directing and leading, Concept, Nature, Scope and principles of Direction, Manager versus leaders; Leadership Theories – Trait Theories, Concept of motivation and how to motivate employees in organisation.

**UNIT 5**

Controlling; Meaning and process of control, Types of control , steps in control process. Control tools and techniques- informational controls and financial controls.

**RECOMMENDED BOOKS**

1. L.M.Prasad. Principal and Practice of Management.
2. George R. Teery and Stephan G. Franklin. Principles of Management. AITBS Publications.
3. Knootz, Harold and Weihrich. Esserentials of Management. TMH Publications.
4. Burton and Thakur. Management Today (Principles and practices). TMH Publications.
5. Stones, Freeman, Gilbreth, Management. PHI Publications 6<sup>th</sup> Edition.

**RATIONALE**

Arabic is becoming a popular language to learn in the Western world, even though Arabic grammar is sometimes very hard to learn for native speakers of Indo-European languages. Many other languages have borrowed words from Arabic, because of its importance in history. This includes support from beginning to study abroad programs, intensive instruction opportunities, teacher exchanges, employment and professional development.

**DETAILED CONTENTS****UNIT 1**

Lesson no. 1 to 6

**UNIT 2**

Lesson no. 7 to 13

**UNIT 3**

Lesson no. 14 to 18

**UNIT 4**

Lesson no. 19 to 23

**UNIT 5**

Al - Quran (from Surah Al-feel to Surah Al-Naas) with translation and brief commentary.

**RECOMMENDED BOOKS**

Duroos-ul-Lughat-il-Arabiyyah li Ghayr-in-Naatiqeena bihaa Part-I by Dr. V Abdul Rahim;  
Published by: Islamic Foundation Trust 78, Perambur High Road Chennai -600012

**DETAILED CONTENTS****UNIT 1**

Introduction: Introduction to operation Research, Linear Programming problem, Formulation of LPP, Graphical solution of LPP, simplex method, artificial variables, big-M method.

**UNIT 2**

Transportation Problems: Formulation, solution of balanced transportation problem. Finding initial basic feasible solutions à €. North-west corner rule, least cost method and Vogoles approximation method.

**UNIT 3**

Assignment Model and Hungarian method: Assignment Model Formulation, Hungarian method for optimal solution; solving unbalanced problems; travelling salesman problem and assignment.

**UNIT 4**

Sequencing Models: Solution of sequencing problem à €; processing n jobs through two machines, à € processing n jobs through three machines à €; Processing two jobs through m machines.

**UNIT 5**

Dynamic Programming: Introduction to Dynamic programming problems, Characteristics and applications of Dynamic Programming, Mathematical formulation and optimal Solution of Dynamic Programming problems.

**RECOMMENDED BOOKS**

1. P. SankaralIyer, à € Operations Research, Tata McGraw Hill 2008
2. A.M. Natarajan, P.Balasubramani, A. Tamilarasi, à € Operations, Pearson Education, 2005.