

**JANARDAN MISHRA GROUP OF INSTITUTIONS**  
MAGHAR-SANT KABIR NAGAR



# **DIPLOMA**

3<sup>rd</sup> Semester & 4<sup>th</sup> Semester

(Mechanical Engineering-Production)(Mechanical  
Engineering-Automobile)

***SCHEME***

***&***

***SYLLABUS***

[Effective from the session 2015-16]

**STUDY AND EVALUATION SCHEME FOR  
THREE YEAR DIPLOMA COURSE IN  
MECHANICAL (PRODUCTION ENGG.& AUTOMOBILE ENGG.)**

**SEMESTER - THIRD**

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme				
			L	T	P	D	Sessional	End Exam	Total	Duration	
<b>THEORY SUBJECT</b>											
1	DAS-31	Applied Mathematics-III	4	1	-	-	20	50	70	2.5	
2	DME-31	Materials & Material Science	4	1	-	-	20	50	70	2.5	
3	DME-32	Thermal Engineering	4	1	-	-	20	50	70	2.5	
4	DME-33	Manufacturing Processes	4	1	-	-	20	50	70	2.5	
<b>PRACTICA/DRAWING SUBJECTS</b>											
5	DCS-31P	Computer Application For Engg. Lab	-	-	4		30	60	90	3	
6	DME-32P	Thermal Engineering Lab	-	-	4		10	20	30	3	
7	DME-33P	Manufacturing Processes Lab	-	-	4		40	80	120	3	
8	DGD-30	Games//Social and Cultural Activities + Discipline ( 15 + 10)							25		
<b>Grand Total</b>									<b>545</b>		

NOTE:- (1) Each period will be 50 minutes duration.

(2) Each session will be of 16 weeks.

(3) Effective teaching will be at least 14 weeks.

(4) Remaining periods will be utilised for revision etc.

**STUDY AND EVALUATION SCHEME FOR  
THREE YEAR DIPLOMA COURSE IN  
MECHANICAL (PRODUCTION ENGG.& AUTOMOBILE ENGG.)**

SEMESTER - Second

S.No.	Subject Code	Name of Subject	Periods Per Week				Evaluation Scheme				
			L	T	P	D	Sessional	End Exam	Total	Duration	
<b>THEORY SUBJECT</b>											
1	DME-41	Mechanics of Solids	4	1	-	-	20	50	70	2.5	
2	DCE-45	Hydraulics & Hydraulic Machines	4	1	-	-	20	50	70	2.5	
3	DEE-44	Electrical Technology & Electronics	4	1	-	-	20	50	70	2.5	
4	DME-42	Mechanical Engg. Drawing	-	-	-	10	20	50	70	3	
<b>PRACTICA/DRAWING SUBJECTS</b>											
5	DME-41P	Mechanics of Solids Lab	-	-	4	-	20	40	60	3	
6	DEE-44P	Electrical Technology & Electronics Lab	-	-	4	-	20	40	60	3	
7	DCE-45P	Hydraulics Lab	-	-	4	-	10	20	30	3	
8	DGD-40	Games//Social and Cultural Activities + Discipline ( 15 + 10)							25		
<b>Grand Total</b>									455		

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## **[DAS-31] APPLIED MATHEMATICS III**

### 1. MATRICES :

1.1 Algebra of Matrices, Inverse :Addition, Multiplication of matrices, Null matrix and a unitmatrix, Square matrix, Symmetric, Skew symmetric, Hermitian,Skew hermition, Orthogonal, Unitary, diagonal and Triangularmatrix, Determinant of a matrix.Definition and Computation of inverse of a matrix.

1.2 Elementry Row/Column Transformation :Meaning and use in computing inverse and rank of a matrix.

1.3 Linear Dependence, Rank of a Matrix :Linear dependence/independence of vectors, Definition and computation of a rank of matrix. Computing rank throughdeterminants, Elementary row transformation and through theconcept of a set of independent vectors,Consistency ofequations.

1.4 Eigen Pairs, Cayley-Hamilton Theorem : Definition and evaluation of eign values and eign vectors ofa matrix of order two and three, Cayley-Hamilton theorem(without Proof) and its verification, Use in finding inverseand powers of a matrix.

### 2. DIFFERENTIAL CALCULUS :

2.1 Function of two variables, identification of surfaces inspace, conicoids

2.2 Partial Differentiation :Directional derivative, Gradient, Use of gradient f, Partialderivatives, Chain rule, Higher order derivatives, Eulenththeorem for homogeneous functions, Jacobians.

2.3 Vector Calculus :Vector function, Introduction to double and triple integral,differentiation and integration of vector functions,gradient, divergence and curl, differential derivatives.

### 3. DIFFERENTIAL EQUATION :

3.1 Formation, Order, Degree, Types, Solution :Formation of differential equations through physical,geometrical, mechanical and electrical considerations,Order, Degree of a differential equation, Linear, Nonlinearequation.

3.2 First Order Equations :Variable seperable, equations reducible to seperable forms,Homogeneous equtions, equtions reducible to homogeneousforms, Linear and Bernoulli form exact equation and theirsolutions.

3.3 Higher Order Linear Equation :Property of solution, Linear differential equation withconstant coefficients (PI for  $X=eax$ ,  $\sin ax$ ,  $\cos ax$ ,  $Xn,eaxV$ ,  $XV$ ).

3.4 Simple Applications :LCR circuit, Motion under gravity, Newton's law of cooling,radioactive decay, Population growth, Force vibration ofa mass point attached to spring with and without dampingeffect. Equivalence of electrical and mechanical system

### 4. INTEGRAL CALCULUS - II:

4.1 Beta and Gamma Functions :Definition, Use, Relation between the two, their use inevaluating integrals.

4.2 Fourier Series :Fourier series of  $f(x)$ ,  $-n < x < n$ , Odd and even function,Halfrange series.

4.3 Laplace Transform :Definition, Basic theorem and properties, Unit step andPeriodic functions, inverse laplace transform, Solution ofordinary differential equations.

### 5. PROBABILITY AND STATISTICS :

5.1 Probability :Introduction, Addition and Multiplication theorem and simpleproblem.

5.2 Distribution :Discrete and continuous distribution, Bionimal Distribution,Poisson Distribution, Normal Distribution..

## **DME-31 MATERIALS & MATERIAL SCIENCE**

GENERAL: Brief introduction to the subject metallurgy and its scope in engineering field, classification of materials of industrial importance. Their chemical thermal, electrical,magnetic, mechanical and technological properties and theirselection criteria for use in industry.

2. STRUCTURE OF METALS AND THEIR DEFORMATION:Structure of metals and its relation to their physical,mechanical and technological properties. Elementary idea of arrangement of atoms in metals, molecular structures crystal structures and crystal imperfections. Deformation ofmetals, effects of cold and hot working operations over them. Recovery ecrystallisation and grain growth, solid solutions, alloys and inter metallic compounds, alotropy of metals, effect of grain size on properties of metals.Corrosion its causes and prevention.

### 3. PROPERTIES AND USAGE OF METALS:

(1) (a) Ferrous Metals.

(b) Non Ferrous Metals.

(2) Nonmetallic Materials.

### 1. METALS:

(a) Ferrous Metals:

- (i) Classification of iron and steel. Sources of iron ores and places of availability. Outline of manufacture of pig iron, wrought iron, cast iron and steel. (Flow diagram only)
- (ii) Cast iron: Types as per I.S. - White, malleable, grey mottled, modular and alloy, properties and common uses.
- (iii) Classification of steels according to carbon content and according to use as per I.S. Mechanical properties of various steels and their uses. Name and places of steel plant in India. Availability of various section of steel in market, its forms and specifications.
- (iv) Alloy Steel : Effect of alloying various elements, viz Cr, Ni, Co, V, W, Mo, Si and Mn on mechanical properties of steel, Common alloy steels, viz,
  - (a) Ni-Steel
  - (b) Ni-Cr-steel
  - (c) Tungsten Steel
  - (d) Cobalt steel
  - (e) Stainless steel
  - (f) Tool steel- High Carbon Steel, High Speed tool Steel, Satellite Metal, Tungsten Carbide Diamonds.
  - (g) Silicon magnese steel
  - (h) Spring steel
  - (i) Heat resisting alloy steels (Nimonic steels).
  - (j) Impact hardening steel

(B) Non-ferrous Materials:

- (i) Important ores and their metal content, outline of manufacturing methods, trade names, properties (Phy/Mech./Elect.) and use of the following metals: Aluminium, Zinc, Copper, Tin, Silver, Lead.
- (ii) Base metal with principle alloying elements (I.S.I. specification). Important properties and use of the following alloys:
  - (a) Aluminium Alloys: Aluminium-Copper alloy, Al, Zn alloy, Aluminium-Silica Alloy-Al-Ni-Alloy, Duraluminium-derived alloys (R.R. and Y-alloy).
  - (b) Copper Alloys: Brass, Bronze, Gun metal, Phosphor Bronze, Aluminium Bronze, Ni Bronze.
  - (c) Nickel Silver: Nickel-Copper Alloy (monel metal) Inconel, Nickel, Silver.
  - (d) Bearing Metals: Lead base alloys, tin base alloys. (White metals or babbit metals) Copper base alloys.
  - (e) Solders: Solders-(Lead, Tin solder, Plumber solder, Tinman's solder or Tin solder) Silver solder, Brazing alloys (spelter), Inconel alloys.

2. NON-METALIC MATERIALS:

- (a) Timber: Conversion of Timber: Its meaning necessity, Seasoning of timber, Preservation of Timber : Types of preservation, Methods of application, Defects in timber, surface treatment, Soaking treatment, Hot and Cold treatment; Common Indian timber species, properties identification, units of purchase. Brief study of products of Timber, Plywood, Hard board, Batten Board, Veneer board.
- (b) Plastic and Other Synthetic Materials: Plastics-Important sources-Natural and Synthetic, Classification, thermoset and thermoplastic, Various trade names, Important Properties and engineering use of plastics. Market forms-Pallets, Granules, Powder and Liquid forms; Uses of Styrene, Linoleum, Plastic coated paper, Fibres-Important sources. Inorganic fibres, Natural Organic Fibres and Synthetic organic fibre and their use.
- (c) Paints, Enamels, Varnishes and Lacquers: Paints and Enamels-types, its purpose, essential ingredients and their role, characteristics of a good paint and enamel, Selection of different types of paints, varnishes from manufacture catalogue.
- (d) Heat Insulating Materials: Classification of heat: Insulating material, properties and uses of China clay, Cork, Slag wool, Glass wool, Thermocole, PUF, Properties and uses of asbestos as filler material.
- (e) Electrical Insulating Materials: Classification of electrical insulating materials, properties and use of-China clay, Leather, Prespan paper, empire cloth masonite, Bakelite, Ebonite, Fibre, Mica, Wood Wool, Glass wool, Rubber, Felt, Insulating oil and Varnish and Enamel paint. Electrical resistance and fuse materials.
- (f) Hardware: General specification, uses and methods of storage of G.I. and C.I. steel, Copper, A.C. pressure conduits, R.C.C. pipes, P.V.C. pipes and their uses. General sheets specification (I.S.) and uses. Method of storage of G.I. sheets, M.S. sheets, General specification of pipe fittings viz. Elbow, Tee, Bend, Crosses and Sockets. General specification and use of wire nails, wood screws and door hinges, toggle bolts, sliding bolts.

4. IDENTIFICATION AND TESTING OF METAL ALLOYS: Selection, specification forms and availability of materials. Testing of materials (Destructive and nondestructive), Identification of metal by giving miniproject.
5. HEAT TREATMENT OF METALS: Elementary concept, purpose, Iron-carbon equilibrium diagram. T.T.T. or 'S' curve in steels and its significance, micro structure of steels and martensitic transformation (elementary idea). Hardening, Tempering, Annealing, Normalising and case hardening. Ageing, Various temperature ranges for different metals and alloy (From heat treatment hand book)
6. MISCELLANEOUS MATERIALS:  
Important properties, characteristics and use of the following materials.
  - (a) Abrasives-Natural and Manufactured, sand stone, emery and corundum, diamond, garnet, silicon carbide, Boron carbide, aluminum oxide, any other abrasives qualities of good abrasive.
  - (b) Celluloid or Xylomite
  - (c) Felt
  - (d) Magnetic Materials
  - (e) Mica
  - (f) Refractory Materials-Fire clay, Dolomite, Magnesite, Poreclain, Fire bricks and their uses
  - (g) Jointing Materials-Glues and Adhesives, Cements Pyroxylene cement, Rubber cement, Magnestic cement.
  - (h) Composite Materials : Introduction to polymers of metal matrix composite, Carbon fibre, Glass fibre
  - (i) Germanium alloys (metal glasses)
  - (j) Source of procurement of various Ferrous and nonferrous and composite materials

## **DME-32 THERMAL ENGINEERING**

### FUNDAMENTAL OF THERMODYNAMICS :

Definition, concept of thermodynamic system and surroundings. Closed system, open system, isolated system, thermodynamics definition of work. Zeroth law of thermodynamics. First law of thermodynamics for cyclic and noncyclic processes. Idea of internal energy and enthalpy. Thermodynamic processes - constant volume, constant pressure, constant temperature (Isothermal) processes, adiabatic process polytropic process, their representation on P-V diagram and calculation of work done. Application of the first law of these process. Simple numerical problems. Second law of thermodynamic concept of perpetual motion machine of first order and that of second order. Concept of heat engine, heat pump and refrigerator. Carnot cycle efficiency for heat engine and cop for refrigerator and heat pump.

ENTROPY - its physical concept and significance, reversibility and efficiency, Irreversibility and entropy. Expression for change of entropy in various thermodynamic processes. Simple numerical problems concerning the above.

2. PROPERTIES OF STEAM : Idea of steam generation beginning from heating of water at 0°C to its complete formation into saturated steam. Pressure temperature curve for steam. Idea of dry saturated steam, wet steam and its dryness fraction, super heated steam and its degree of super heat. Enthalpy, entropy, specific volume and saturation pressure and temperature of steam. Use of steam table and mollier chart. Simple numerical problems.

3. STEAM GENERATORS: Types of steam generators - Low pressure and High pressure boilers, Modern high pressure high discharge boiler - Stirling boiler, Lamont, Loefflor, Benson, Velox, ramsin and Schmidt-Hartmann boiler, Computer controlled accessories, Equivalent evaporation, Boiler performance efficiency.

4. A STEAM TURBINE : Classification, details of turbine, working principle of impulse and reaction turbine, compounding methods of steam turbine, efficiency bleeding, concept of steam nozzles, governing of turbine.

### B. STEAM CONDENSER :

Principle of operation, classification, A brief concept of condenser details.

5. GAS TURBINE : Elements of gas turbine, working principle, fuel and fuel system, open and close cycle, methods of testing, operating characteristics, Atkinson cycle, Brayton cycle, Heat exchanger, Inter cooler, Reheater, Applications, Performance. Brief concept of heat exchanger.

6. AIR COMPRESSOR : Definition and their use, Difference between reciprocating and rotary compressor, their types and working work done during compression in single stage and two stage, Heat rejected and inter cooling in two stage compression, volumetric efficiency, compressor lubrication.

7. THERMAL POWER PLANT : Main parts and working of plant, Thermodynamics cycle, Fuel handling, Combustion and combustion equipments, Problem of ash disposal, Circulating of water schemes and supply of make

up water, Selection of economiser, Super heater, Preheater, Feed water heater and dust collector, Steam powerplant, Heat balance and efficiency.

8. NUCLEAR POWER PLANT :Elements of nuclear power plant, Types of nuclear reactor, Fuel moderators, Coolants, Controls, Disposal of nuclear wastes, Classification of nuclear power plant, Cost of nuclear power, Nuclear fuels.

9. INTEGRAL COMBUSTION PLANT :Engine classification, Engine cycle, C.I. engine combustion, S.I. engine combustion, Engine structure, Fuel admission system, Air intake system, Engine cooling system, Lubrication system, Engine starting system, I.C. engine in steam plant-Features and working.

10. REFRIGERATION & AIRCONDITIONING SYSTEM :Different types of refrigeration principles and refrigerants. Working of domestic refrigerator. Working of Window/Split type AC system.

## **DME-33 MANUFACTURING PROCESS**

1.(A)-GENERAL FORMING PROCESSES:Classification and elementary idea of metal forming processes on the basis of the properties of deformability (Plasticity), fusibility and divisibility Viz Rolling, Forging, Drawing, Extruding, Spining, Pressing, Punching, Blanking.

(B)-WELDING:

(I) Welded preparation, Introduction to various welding processes with procedure equipments and applications such as (i) Electric arc welding.

(ii) Resistance welding-Spot welding, Flash butt, Percussion welding.

(iii) Thermit welding.

(iv) Carbon arc welding

(v) Metal-Inert-Gas welding (MIG).

(vi) Tungsten arc welding (TIG).

(vii) Atomic Hydrogen arc welding.

(viii) Stud welding.

(ix) Laser Beam, Electromagnetic Beam Welding, Explosive Welding, Ultrasonic Welding.

(x) Under water welding

(xi) Submerged Arc welding

(II) WELDING:Definition, arc initiation, arc structures, types of arc, metal transfer characteristics and influencing parameters, weld bead geometry, various types of electrodes used in various processes. Selection of electrode from catalogue, current and voltage setting from welder's hand book.

(III) WELDING OF SPECIAL MATERIALS:

(i) Welding of plastics, equipment, filler, rods, weldability, procedures and precautions.

(ii) Welding of Grey Cast Iron, shielded metal arc gas welding procedures.

(iii) Welding of Aluminium, Argon arc and gas welding procedures.

(iv) Welding of copper, Brass and Bronze, Gas shielded metallic arc welding, TIG., Oxyacetylene method.

(v) Welding of Alloy steels welding, Stainless steel, welding by oxyacetylene process, MIG, TIG. Specification of electrode as per latest I.S. code.

(IV) TESTING OF WELDS & RELEVANT WELDING CODES:

(a) Destructive methods.

(b) Non destructive methods-visual, X-ray, Gamma-ray, Magnetic particles, flaw detection, fluorescent, dye penetrant and ultrasonic testing.

(V) COST ESTIMATION OF WELDING :Material cost, Fabrication cost, Preparation cost, Welding cost and Finishing cost, Over head cost, Cumulative effect of poor practices on cost, Calculation of cost of welding gas consumption and welding electrodes.

2. FOUNDRY PRACTICE:

(A) PATTERN AND MOULDING:The pattern materials used, Types of patterns, Allowances and pattern layout, Colour scheme pattern defects, Types of cores and their utility. Moulding Processes:Classification of mould materials according to characteristics, Types of sands and their important test, parting powders and liquids. Sand mixing and preparation, Moulding defects.

### (B) MELTING AND POURING:

Fuels and metallic materials used in foundry. Melting furnaces used in foundry such as pit furnace, Tilting and cupola furnaces, metals and alloys. Additions to molten metal, Closing and pouring of the moulds. Coring-up, venting and closing, use of ladles, spur and risers, Defects due to closing and spurring. Basic idea of fettling operations. Surface treatment, Salvaging of castings, Factors determining soundness of casting. Handling of molten metal from furnace to mould.

(C) SPECIAL CASTING: Elementary idea of special casting processes-Shell mould casting, die casting, investment mould casting, centrifugal and continuous casting full mould casting. Elementary idea of mechanisation of foundries.

(D) ESTIMATING AND COSTING : Calculation of material cost for casting and Forging.

### 3. POWDER METALLURGY:

Introduction, principle, scope and names of processes. Production of metal powders, compaction, sintering and sizing. Self lubricated bearings. Advantages of the process and its limitations. (Elementary concept only).

4. MODERN MACHINING PROCESS: Ultrasonic Machining (USM), Electro Chemical Machining (ECM), Electro Chemical Grinding (ECG), Electrical Discharging Machining (EDM), Laser Beam Machining (LBM), Electro Beam Machining (EBM), Plasma Arc Machining (PAM)

## **[DCS-31P] COMPUTER APPLICATION FOR ENGINEERING LAB**

1. Introduction to Computer: Block Diagram of Computer, Types Of Computer Central Processing unit (Control unit, A.L.U.) & memory Unit. Types of Input and Output devices and memories. Visual Display Unit, Keyboard, Floppy disk drive, Hard disk drive, CD-ROM Drive, Magnetic & Tape Drive. Number system (Conversion) Binary, Octal, Hexa decimal number system, Conversion from Decimal to Other System and vice-versa Bit, Byte and Word.

2. INTRODUCTION TO OPERATING SYSTEMS (MS-DOS/MS-WINDOWS:) What is operating system, its significance, Commands of DOS, Features/Application of window.

3. MS WORD: File : Open, Close, Save, Save as, Search, Send to, Print Preview, Print and Page Setup Edit : Cut, Copy, Paste, Office Clipboard, Select All, Find, replace, Goto, etc. View : Normal/Web Layout/Print Layout; Tool Bars; Header/Footer; Zoom, etc. Insert: Break, Page Number, Date & Time, Symbol, Comment, Reference, etc. Format: Font, Paragraph, Bullets & Numbering, Borders & Shading, Column, Change case, Back ground, etc. Tools : Spelling & Grammar, Language, Word Count, Letters & Mailing, Options, Customize, etc. Table : Draw, Insert, Delete, Select, Auto Format, AutoFit, Convert, Sort, Formula, etc.

4. MS EXCEL: Introduction, Use of Tools/Icons for preparing simple applications.

5. MS POWER POINT : Introduction, Use of Tools/Icons for preparing simple presentation on Power Point.

6. MS ACCESS : Introduction, Use of Tools/Icons for preparing simple applications.

7. Introduction to Internet: What is Network, How to send & receive messages, Use of Search Engines, Surfing different web sites. Creating MailID, Use of Briefcase, Sending./replying emails.

8. Concept of Programming : Flowcharting, Algorithm techniques, etc.

### **List Of Practicals**

1. Practice on utility commands in DOS.

2. Composing, Correcting, Formatting and Article (Letter/Essay/Report) on MS Word and taking its print out.

3. Creating, editing, modifying tables in MS ACCESS.

4. Creating labels, report, generation of simple forms in MS-ACCESS.

5. Creating simple spread sheet, using in built functions in MS-EXCELL.



6. Creating simple presentation on Power Point.
7. Creating mail ID, Checking mail box, sending/replying emails.
8. Surfing web sites, using search engines.

### **[DME-32P] THERMAL ENGINEERING LAB**

1. Determination of temperature by
  - i. Thermo couple
  - ii. Pyrometer
2. Study of constructional details and specification of highpressure boiler and sketch (through field visit)
3. Demonstration of mounting and accessories on a boiler forstudy and sketch (field visit).
4. Performance testing of steam boiler.
5. Study of steam turbines through models and visits.
6. Determination of dryness fraction of wet steam sample.
7. Study and sketching of various hand tools, Lifting tackses,Gadgets used in plant.
8. Study of fuel sypply and lubrication system in I.C. engine.
9. Study of battery ignition system of a multi-cylinder petrolengine stressing on ignition timing, setting fixing order and contact breaker gap adjustment.
10. Determination of B.H.P. for diesel and petrol engine bydynamometer.
11. Morse test on multi-cylinder petrol engine
12. To prepare heat balance sheet for diesel/petrol engine.
13. Demonstration & study of air conditioning system anddomestic refrigerating system

### **[DME-33P] MANUFACTURING PROCESSE LAB**

#### I. FOUNDRY PRACTICE (WORKSHOP):

Minimum work in each section is indicated against that

#### 1. PATTERN MAKING:

(a) Making Patterns (At least two).

(i) Solid one piece pattern.

(ii) Split two piece pattern.

(iii) Split three piece pattern. (iv) Gated pattern.

(v) Four Piece pattern.

(vi) Sweep pattern. (vii)

Skeleton pattern. (viii)

Segmental pattern.

(b) MAKING CORE BOXES (At Least 2 ) For:

(i) Straight Core Box.

(ii) Bent Core Box.

(iii)Unbalanced Cores.

#### 2. SAND PREPARATION AND TESTING:

(a) Sand Testing (At Least 2 Experiments).

(i) Grading (Grain Size).

(ii) Determination of Moisture content

(iii) Determination of Clay content.

(iv) Determination of Permeability for gases.

(b) Preparation of :

(i) Green Sand Composition.

- (ii) Dry Sand Composition.
- (iii) Loam Sand Composition.
- (iv) Oil Sand For Cores.

### 3. MOULDING:

(a) Making at least 8 sand moulds of different forms with different types of pattern using.

- (i) Floor Moulding.
- (ii) Two Box Moulding.
- (iii) Three Box (or more) Moulding.

(b) At least one of the following :

- (i) Making and setting of cores of different types.
- (ii) Making one shell mould apparatus.

### 4. MELTING AND POURING:(Each to be Demonstrated at least once in the session).

(a) Demonstration of Melting of cast iron in

- (i) Pit Furnace.
- (ii) Cupola.

(b) Demonstration of melting a Non-Ferrous metal in :

- (i) Pit Furnace.
- (ii) Tilting Furnace.

(c) Pouring of Metals in Moulds (Ferrous and Non-Ferrous).

### 5. CLEANING, INSPECTION AND NON DESTRUCTIVE TESTING:

(a) Shaking, cleaning and fettling of casting (At least 2 Casting).

(b) (i) Inspection of cast component (visual) and preparing inspection report (At least one report). (ii) Establishing cause of Defects seen (At least one cause).

(iii) Dye penetration test for casting

(iv) Magnetic flux detection test/Ultrasonic flaw detection test for castings.

### 6. CASE STUDY OF:

At least 2 sand casting products from sand preparation, pattern layout to final finished casting by shell moulding, centrifugal casting, investment casting and continuous casting.

### 7. ADVANCE WELDING SHOP :

(a) Study of various Gas cutting and welding equipments :- Welding transformer, Generator/rectifier, Gas cylinder, Gas cutting machines, Cutting torches etc., Various electrodes and filler metals and fluxes. Practice of welding and cutting of different metals by making suitable jobs by different methods :-

1. Arc Welding practice of mild steel (M.S.) and Spot welding on stainless steel jobs.
2. Tig Welding practice of Non-Ferrous metals, like Copper, Brass and Aluminium.
3. Practice of Gas cutting manually.
4. Practice of Gas cutting by cutting machine.
5. Practice of Arc cutting.
6. Study of Welding defects.
7. Inspection and Tests of welded joints.
8. Practice of Spot and Seam welding.
9. Practice of Welding pipe joints, Pipes and Pressure vessels.
10. Exercise on EDM Machine