

Trade: Machine Shop Practice

COURSE STRUCTURE

Sl. No.	Subject	Hours Per Course	
		Lecture	Workshop
01.	Shop Theory	12	418
02.	Related Shop Mathematics	12	00
03.	Technical Drawing	12	00
04.	Measuring Tools and Hand Tools	12	00
05.	Basic Cutting Tool Design	06	00
06.	Safety and Maintenance	06	00
07.	Engineering Materials	06	00
08.	Heat Treatment	06	00
	Total	72	418
	Grand Total		490

COURSE OUTLINE

Subject: Shop Theory

Relationship between cutting speed, feed and depth of cut, use of speed and feed table for calculations. Methods of taper turning, mating of taper system, screw cutting: acme, square, trapezoidal; single and multi-start threads; common applications of multi-start threads; Effects of helix angle of the threads on tool angle and setting; common methods of form turning, turret lathe, production type threading tools, dimensional standards, description of drill press and boring machine, reaming and tapping, precision single spindle and gang drilling machine, horizontal boring for multi-cylinder engine block, uses of shaper, planer and slotting machine, speeds and feed for operation, horizontal, vertical and universal milling machines, essential features, action and application, gear and sprocket cutting, mounting and balancing of grinding wheels; precision grinding and surface finish, care of grinding wheels; causes and effects of wheel loading, wheel glazing, excessive wheel wear during grinding, centre less grinding; dimensional standards and inspection.

Workshop practice: Practical works based on Shop Theory.

Subject: Related Shop Mathematics

Units of length, area, volume, mass and force etc; unit conversion, workshop calculations of fractions, decimals, percentages, average; use of tables, calculations on taper turning, thread cutting, cutting speeds, RPM, stroke per minute; calculations on spur, helical, worm and bevel gears, indexing head; speed ration on gear, sprocket, pulley etc.

Subject: Technical Drawing

Introduction, importance of drawing for engineers and technicians; drawing instruments and their uses; types of drawing, component (part/detail) drawing, collective drawing, sub-assembly drawing, general assembly drawing; geometric drawing: straight line, angle, square, parallelogram, polygon, circle, parabola, ellipse; Projection drawing- definition, classic function, orthographic projection (1st & 3rd angle projection), isometric and oblique projection; dimensioning- outside, inside, radius, angle, taper, tolerance; importance of auxiliary views, sectional views and hidden details; conventional representation of components and symbols (nut, bolt, shaft, gear, welding, surface finish, materials, legend etc); different types of limits and fits:, transition and interference (shrinkage, expansion, pressure and force); meaning of - allowance, tolerance, upper limit and lower limit .

Workshop Practice: Practical works based on technical drawing.

Subject: Measuring Tools and Hand Tools.

Introduction to measurement; units and standards of measurement; types of measurement; different types of non-precision measuring tools: steel rule, measuring tape etc; different types of precision measuring tools; vernier calliper; micrometer, vernier micrometer, bevel protector; sine bar, gear tooth vernier; different types of gauges- height, filler, surface, telescopic gauges, use and care of measuring tools, hammers, punches, pliers, wrenches etc.

Subject: Safety and Maintenance

Introduction on safety and maintenance, its importance; fire classification, causes and prevention; safety rules and its necessity; safety on working place; safety equipment (Fire extinguisher, fire hydrant); causes of accident and its preventive measures; first aid; first aid technique (circulating system and breathing system); care of tools; cleaning of working place; general maintenance; routine maintenance; trouble shooting; fault analysis and functional testing.

Subject: Engineering Materials

Introduction, classification of engineering materials ferrous, nonferrous; polymer plastic, rubber and fiber; ceramic and glass, composites; brief introduction on iron and steel pig iron, wrought iron, gray cast iron, white cast iron, malleable iron, chilled cast iron, nodular cast iron, alloy cast iron, plain carbon steel and alloy steel; properties of metals: physical, mechanical (yield strength, ultimate tensile strength, breaking strength, compressive strength, fatigue strength, creep strength) chemical, thermal, electrical and optical properties; effects of alloying elements carbon, silicon, manganese, sulfur, phosphorous, chromium, nickel, vanadium, molybdenum, tungsten and cobalt; manufacturing processes of metal components casting, plastic working (forging, hammering, rolling, deep drawing, spinning), powder metallurgy, machining, welding and fabrication; identification of metals: color, file, chips, spark, density, chemical analysis etc.

Subject: Heat Treatment

Introduction, objectives, salient features of iron and carbide diagram, different types of heat treatment furnaces and accessories, steps to heat treatment; heat treatment processes, different types of cooling medium, factors affecting hardenability, hardening defects; case hardening and its significance, different case hardening processes, demonstration of heat treatment operations and trouble shooting

Subject: Basic Cutting Tool Design

Tool nomenclature, tool materials, types of cutters: end mill cutter, shell mill cutter, slotting cutter, slitting saw cutter, side and face milling, gear cutter, drill bit, reamer, tap, die, grinding wheel etc; cutting parameter- cutting speed, depth of cut, feed; work materials.

Trade : Mechanical Drafting

COURSE STRUCTURE

Sl. No.	Subject	Hours Per Course	
		Lecture	Workshop
01.	Technical Drawing	12	418
02.	Shop Theory	12	00
03.	Related Shop Mathematics	12	00
04.	Measuring Tools	12	00
05.	Basic Cutting Tool Design	06	00
06.	Safety and Maintenance	06	00
07.	Engineering Materials	06	00
08.	Heat Treatment	06	00
	Total	72	418
	Grand Total		490

COURSE OUTLINE

Subject: Technical Drawing

Introduction, importance of drawing for engineers and technicians; drawing instruments and their uses; types of drawing, component (part/detail) drawing, collective drawing, sub-assembly drawing, general assembly drawing: geometric drawing: straight line, angle, square, parallelogram, polygon, circle, parabola, ellipse; Projection drawing-definition, classic function, orthographic projection (1st & 3rd angle projection), isometric and oblique projection; dimensioning- outside, inside, radius, angle, taper, tolerance; importance of auxiliary views, sectional views and hidden details; conventional representation of components and symbols (nut, bolt, shaft, gear, welding, surface finish, materials, legend etc); different types of limits and fits:, transition and interference (shrinkage, expansion, pressure and force); meaning of - allowance, tolerance, upper limit and lower limit .

Workshop Practice: Practical works based on technical drawing.

Subject: Shop Theory

Relationship between cutting speed, feed and depth of cut, use of speed and feed table for calculations. Methods of taper turning, mating of taper system, screw cutting: acme, square, trapezoidal; single and multi-start threads; common applications of multi-start threads; Effects of helix angle of the threads on tool angle and setting; common methods of form turning, turret lathe, production type threading tools, dimensional standards, description of drill press and boring machine, reaming and tapping, precision single spindle and gang drilling machine, horizontal boring for multi-cylinder engine block, uses of shaper, planer and slotting machine, speeds and feed for operation, horizontal, vertical and universal milling machines, essential features, action and application, gear and sprocket cutting, mounting and balancing of grinding wheels; precision grinding and surface finish, care of grinding wheels; causes and effects of wheel loading. wheel glazing, excessive wheel wear during grinding, centre less grinding; dimensional standards and inspection.

Subject: Related Shop Mathematics

Units of length, area, volume, mass and force etc; unit conversion, workshop calculations of fractions, decimals, percentages, average; use of tables, calculations on taper turning, thread cutting, cutting speeds, RPM, stroke per minute; calculations on spur, helical, worm and bevel gears, indexing head; speed ratio on gear, sprocket, pulley etc.

Subject: Measuring Tools

Introduction to measurement; units and standards of measurement; types of measurement; different types of non-precision measuring tools: steel rule, measuring tape etc; different types of precision measuring tools; vernier calliper; micrometer, vernier micrometer, bevel protector; sine bar, gear tooth vernier; different types of gauges- height, filler, surface, telescopic gauges, use and care of measuring tools, hammers, punches, pliers, wrenches etc.

Subject: Safety and Maintenance

Introduction on safety and maintenance, its importance; fire classification, causes and prevention; safety rules and its necessity; safety on working place; safety equipment (Fire extinguisher, fire hydrant); causes of accident and its preventive measures; first aid; first aid technique (circulating system and breathing system); care of tools; cleaning of working place; general maintenance; routine maintenance; trouble shooting; fault analysis and functional testing.

Subject: Engineering Materials

Introduction, classification of engineering materials: ferrous, nonferrous; polymer-plastic, rubber and fiber; ceramic and glass, composites; brief introduction on iron and steel: pig iron, wrought iron, gray cast iron, white cast iron, malleable iron, chilled cast iron, nodular cast iron, alloy cast iron, plain carbon steel and alloy steel; properties of metals: physical, mechanical (yield strength, ultimate tensile strength, breaking strength, compressive strength, fatigue strength, creep strength), chemical, thermal, electrical and optical properties; effects of alloying elements :carbon, silicon, manganese, sulfur, phosphorous, chromium, nickel, vanadium, molybdenum, tungsten and cobalt; manufacturing processes of metal components-casting, plastic working (forging, hammering, rolling, deep drawing, spinning), powder metallurgy, machining, welding and fabrication; Identification of metals: color, file, chips, spark, density, chemical analysis etc.

Subject: Heat Treatment

Introduction ,objectives, salient features of iron and carbide diagram, different types of heat treatment furnaces and accessories, steps to heat treatment; heat treatment processes, different types of cooling medium, factors affecting harden ability, hardening defects; case hardening and its significance, different case hardening processes, demonstration of heat treatment operations and trouble shooting

Subject: Basic Cutting Tool Design

Tool nomenclature, tool materials, types of cutters: end mill cutter, shell mill cutter, slotting cutter, slitting saw cutter, side and face milling cutter, gear cutter, drill bit, reamer, tap, die, grinding wheel etc, cutting parameter: cutting speed, depth of cut, feed, work materials.

Trade: Automobile**COURSE STRUCTURE**

Sl. No.	Subject	Hours Per Course	
		Lecture	Workshop
01.	Automobile Engine	12	105
02.	Power Transmission and Steering System	12	80
03.	Fuel Injection, Suspension and Brake System	12	105
04.	Auto Electricity	12	70
05.	Auto Parts Machining and Auto Body Denting & Painting	06	35
06.	Hand and Measuring Tools	06	35
	Total	60	430
	Grand Total		490

Subject: Auto Engine,

Introduction, classification, working principle, parts of conventional auto engine-cylinder block, cylinder liners, cylinder head, oil tank, manifolds, heat control valve, crankshaft, fly wheel, connecting rod, piston, piston ring, piston pin, piston clearance in cylinder, methods of re-alignment of connecting rod, main bearing arrangement; camshaft, tappet, valve, valve spring, push rod, rocker and rocker arm, rocker shaft, timing gear, chains and sprockets, oil pump, oil tank and oil relief valve, engine lubrication system; characteristics of lubricating oil of lubrication system, parts of lubrication system: oil tank, oil pump, oil relief valve, oil filter, oil dipstick, oil pressure: indicating light and oil pressure gauge; engine cooling system: air cooling and water-cooling; parts of the water-cooling system: radiator, radiator cap, overflow tank, fan, water pump, thermostat valve and temperature gauge or indicator.

Workshop Practice: Practical works based on Auto Engine**Subject: Power Transmission and Steering System**

Introduction, types and main parts of the transmission system: clutch, gear box, propeller shaft, universal joint and differential, introduction to clutch, classification of clutch, main parts of clutch-driving plate, driven plate and pressure plate, working principle of clutch; introduction to gearbox, classification of gearbox, main components of gearbox: housing, shafts, bearing and gears; working principle of gearbox, introduction to steering system, classification of steering system, main parts of steering system: steering wheel, steering linkages, steering knuckle, steering column and steering gear box, working principle of steering system, factor affecting steering.

Workshop Practice: Practical works based on Power Transmission and Steering System

Subject: Fuel Injection, Suspension and Brake System

Introduction to: suspension system, brake system, fuel and fuel injection system; main parts of suspension system: springs, shock absorbers, stabilizers, axles and wheels; steering geometric-camber, caster, KPI, toe in and toe out; wheel in details, wheel type, wheel parts; types of brake system; main parts brake system, brake pedal, brake drum, brake shoe, brake pad; wheel marking, wheel cylinder, master cylinder and brake oil, tire & tube; trouble shooting of break system and ABS; fuel qualities and fuel properties- flash point, fire point, fuel rating, octane number, octane number and diesel index; components of petrol engine, fuel injection system- tank, fuel filter, fuel pump, carburetor, air cleaner and fuel gauge; components of diesel engine fuel injection system: tank, fuel filter, fuel pump; **compressed natural gas (CNG) and electronic fuel injection (EFI) system; catalytic converter.**

Workshop Practice: Practical works based on Fuel, Suspension and Brake System.

Subject: Auto Electricity

Introduction to auto electricity; different types of electrical system-starting system, charging system, ignition and lighting system etc; components of starting system and their function; self-starter, storage battery, starter switch; components of charging system and their function-generator, storage battery, ampere meter, cutout and regulators; introduction to ignition system, classification of ignition system; components of starting system and their function- storage battery, ignition switch, ammeter, ignition coil, distributor and spark plugs; components of lighting system and their function- various lamps or lights, switches, fuse and circuit breakers and junction box; various types of lights and their uses- head lights, side or parking lights, tail and stop lights, dash lights, cab and body lights.

Workshop Practice: **Practical works based on Auto Electricity**

Subject: Auto Parts Machining and Body Denting and Painting

Introduction, importance to auto parts machining, piston clearances in cylinders methods of realignment of connecting rods, clearances of small-end and big, end bearing; main bearing arrangements; cylinder bearing nahd crankshaft reconditioning denting and painting; operations for machining auto parts, machine tools for machining auto parts; different devices for denting the body of auto vehicle; denting technique; objectives of painting; ingredients of paints. resin, solvent, pigment and extender etc; types of soil-old pigment, scale, rust, grease, mud /dust particles; removal technique of different types of soils; different paint applying technique: brush, spray gun, electrostatic and electro coating; composition of putting and its importance; sequence of application of different layers of paint and finishing operation.

Workshop Practice: **Practical Works Based on Auto Parts Machining and Body Denting and Painting**

Subject: Hand Tools and Measuring Tools

Introduction to measurement; units and Standards of measurement; types of measurement; different types of non-precision measuring tools: steel rule, measuring tape etc; different types of precision measuring tools; vernier calliper; micrometer, vernier micrometer, bevel protector; sine bar, gear tooth vernier; different types of gauges-height, filler, surface, telescopic gauges, use and care of measuring tools. Hammers, punches, pliers, wrenches etc.

Trade : Auto Electricity

COURSE STRUCTURE

Sl. No.	Subject	Hours Per Course	
		Lecture	Workshop
01.	Automobile Engine	12	105
02.	Power Transmission and Steering System	12	70
03.	Fuel Injection, Suspension and Brake System	12	60
04.	Auto Electricity	12	125
05.	Auto Parts Machining and Auto Body Denting & Painting	06	35
06.	Hand and Measuring Tools	06	35
	Total	60	430
	Grand Total		490

Course outline

Subject: Auto Engine,

Introduction, classification, working principle, parts of conventional auto engine-cylinder block, cylinder liners, cylinder head, oil tank, manifolds, heat control valve, crankshaft, fly wheel, connecting rod, piston, piston ring, piston pin, piston clearance in cylinder, methods of re-alignment of connecting rod, main bearing arrangement; camshaft, tappet, valve, valve spring, push rod, rocker and rocker arm, rocker shaft, timing gear, chains and sprockets, oil pump, oil tank and oil relief valve, engine lubrication system; characteristics of lubricating oil of lubrication system, parts of lubrication system: oil tank, oil pump, oil relief valve, oil filter, oil dipstick, oil pressure: indicating light and oil pressure gauge; engine cooling system: air cooling and water-cooling; parts of the water-cooling system: radiator, radiator cap, overflow tank, fan, water pump, thermostat valve and temperature gauge or indicator.

Workshop Practice: **Practical works based on Auto Engine**

Subject: Power Transmission and Steering System

Introduction, types and main parts of the transmission system: clutch, gear box, propeller shaft, universal joint and differential, introduction to clutch, classification of clutch, main parts of clutch-driving plate, driven plate and pressure plate, working principle of clutch; introduction to gearbox, classification of gearbox, main components of gearbox: housing, shafts, bearing and gears; working principle of gearbox, introduction to steering system, classification of steering system, main parts of steering system: steering wheel, steering linkages, steering knuckle, steering column and steering gear box, working principle of steering system, factor affecting steering.

Workshop Practice: **Practical works based on Power Transmission and Steering System**

Subject: Fuel Injection, Suspension and Brake System

Introduction to: suspension system, brake system, fuel and fuel injection system; main parts of suspension system: springs, shock absorbers, stabilizers, axles and wheels; steering geometric-camber, caster, KPI, toe in and toe out; wheel in details, wheel type, wheel parts; types of brake system; main parts brake system, brake pedal, brake drum, brake shoe, brake pad; wheel marking, wheel cylinder, master cylinder and brake oil, tire & tube; trouble shooting of break system and ABS; fuel qualities and fuel properties- flash point, fire point, fuel rating, octane number, octane number and diesel index; components of petrol engine, fuel injection system- tank, fuel filter, fuel pump, carburetor, air cleaner and fuel gauge; components of diesel engine fuel injection system: tank, fuel filter, fuel pump; compressed natural gas (CNG) and electronic fuel injection (EFI) system; catalytic converter.

Workshop Practice: **Practical works based on Fuel, Suspension and Brake System.**

Subject: Auto Electricity

Introduction to auto electricity; different types of electrical system-starting system, charging system, ignition and lighting system etc; components of starting system and their function; self-starter, storage battery, starter switch; components of charging system and their function-generator, storage battery, ampere meter, cutout and regulators; introduction to ignition system, classification of ignition system; components of starting system and their function- storage battery, ignition switch, ammeter, ignition coil, distributor and spark plugs; components of lighting system and their function- various lamps or lights, switches, fuse and circuit breakers and junction box; various types of lights and their uses- head lights, side or parking lights, tail and stop lights, dash lights, cab and body lights.

Workshop Practice: Practical works based on Auto Electricity

Subject: Auto Parts Machining and Body Denting and Painting

Introduction, importance to auto parts machining, piston clearances in cylinders methods of realignment of connecting rods, clearances of small-end and big, ϕ end bearing; main bearing arrangements; cylinder bearing and crankshaft reconditioning denting and painting; operations for machining auto parts. machine tools for machining auto parts; different devices for denting the body of auto vehicle; denting technique; objectives of painting; ingredients of paints. resin, solvent, pigment and extender etc; types of soil-old pigment, scale, rust, grease, mud /dust particles; removal technique of different types of soils; different paint applying technique: brush, spray gun, electrostatic and electro coating; composition of putting and its importance; sequence of application of different layers of paint and finishing operation.

Workshop Practice: **Practical Works Based on Auto Parts Machining and Body Denting and Painting**

Subject: Hand Tools and Measuring Tools

Introduction to measurement; units and Standards of measurement; types of measurement; different types of non-precision measuring tools: steel rule, measuring tape etc; different types of precision measuring tools; vernier calliper; micrometer, vernier micrometer, bevel protector; sine bar, gear tooth vernier; different types of gauges-height, filler, surface, telescopic gauges, use and care of measuring tools. Hammers, punches, pliers, wrenches etc.

Trade : Electroplating

COURSE STRUCTURE

Sl. No.	Subject	Hours Per Course	
		Lecture	Workshop
01.	Fundamentals of Electroplating	12	336
02.	Process Control and Safety Measures	06	132
03.	Engineering Materials	06	00
04.	Heat Treatment	06	00
05.	Measuring Tools and Hand Tools	06	00
	Total	36	468
	Grand Total		504

Course outline

Subject: Fundamentals of Electroplating

Introduction, objectives, different type of soils and their removal technique,, different types of coating processes, pretreatment of electroplating, basic principle of electroplating, preparation of electrolyte for deposition of different metals, different parameters of electroplating, electrolytes, temperature, concentration, agitation, composition, current density, pH of solution, additives such as leveler, brightener, post treatment of electroplated articles.

Workshop Practice: Practical works based on fundamentals of electroplating

Subject: Process Control and Safety Measures

Maintenance of electrolytes, manufacture of electroplating tank, lining materials of electroplating, equipment of electroplating technique, ammeter, voltmeter, rectifier, drier, wire brush, bob/mob, cleaning barrel, abrasive, preparation of grinding/polishing/lapping wheel, floor construction of electroplating shop, making a lay out of modern electroplating shop, filtration of electrolytes, analysis of electroplating solution, trouble shooting.

Workshop Practice: Practical works based on Process Control and Safety Measures

Subject: Engineering Materials

Introduction to heat treatment & its classification of engineering materials: ferrous, nonferrous; polymer-plastic, rubber and fiber; ceramic and glass, composites; brief introduction on iron and steel: pig iron, wrought iron, gray cast iron, white cast iron, malleable cast iron, chilled cast iron, nodular cast iron, alloy cast iron, plain carbon steel and alloy steel; properties of metals: physical, mechanical (yield strength, ultimate tensile strength, breaking strength, compressive strength, fatigue strength, creep strength), chemical, thermal, electrical and optical properties; effects of alloying elements :carbon, silicon, manganese, sulfur, phosphorous, chromium, nickel, vanadium, molybdenum, tungsten and cobalt; manufacturing processes of metal components-casting, plastic working (forging, hammering, rolling, deep drawing, spinning), powder metallurgy, machining, welding and fabrication; Identification of metals: color, file, chips, spark, density, chemical analysis etc.

Subject: Heat Treatment

Introduction, objectives, salient features of iron and carbide diagram, different

types of heat treatment furnaces and accessories, steps to heat treatment; heat treatment processes, different types of cooling medium, factors affecting harden ability, hardening defects; case hardening and its significance, different case hardening processes, demonstration of heat treatment operations and trouble shooting

Subject: Measuring Tools and Hand Tools

Introduction to measurement; units and standards of measurement; types of measurement; different types of non-precision measuring tools: steel rule, measuring tape etc; different types of precision measuring tools; vernier calliper; micrometer, vernier micrometer, bevel protector; sine bar, gear tooth vernier; different types of gauges- height, filler, surface, telescopic gauges, use and care of measuring tools, hammers, punches, pliers, wrenches etc.

Trade : Heat Treatment

COURSE STRUCTURE

Sl. No.	Subject	Hours Per Course	
		Lecture	Workshop
01.	Heat Treatment	6	315
02.	Furnace Design	6	105
03.	Engineering Materials	6	00
04.	Safety and Maintenance	6	46
	Total	24	466
	Grand Total		490

Subject: Heat Treatment

Introduction to heat treatment & its objectives, salient features of iron and carbide diagram, different types of heat treatment furnaces and accessories, steps to heat treatment; heat treatment processes, different types of cooling medium, factors affecting harden ability, hardening defects; case hardening and its significance, different case hardening processes, demonstration of heat treatment operations and trouble shooting

Workshop Practice: **Practical works based on Heat Treatment**

Subject: Furnace Design

Introduction to heat treatment furnaces; basic components and accessories of furnaces fundamentals of heat transfer and requirements of a furnace; types of heat treatment furnaces different types of refractory bricks; types of fuels and their application to heat treatment; determination of shell and lining thickness of a furnace; selection and application of appropriate burner and chimney of a furnace; estimation of raw materials to fabricate a heat treatment furnace.

Workshop Practice: **Practical works based on furnace design**

Subject: Engineering Materials

Introduction, classification of engineering materials: ferrous, nonferrous; polymer-plastic, rubber and fiber; ceramic and glass, composites; brief introduction on iron and steel: pig iron, wrought iron, gray cast iron, white cast iron, malleable cast iron, chilled cast iron, nodular cast iron, alloy cast iron, plain carbon steel and alloy steel; properties of metals: physical, mechanical (yield strength, ultimate tensile strength, breaking strength, compressive strength, fatigue strength, creep strength), chemical, thermal, electrical and optical properties; effects of alloying elements :carbon, silicon, manganese, sulfur, phosphorous, chromium, nickel, vanadium, molybdenum, tungsten and cobalt; manufacturing processes of metal components-casting, plastic working (forging, hammering, rolling, deep drawing, spinning), powder metallurgy, machining, welding and fabrication; Identification of metals: color, file, chips, spark, density, chemical analysis etc.

Subject: Safety and Maintenance

Introduction on safety and maintenance and its importance; Introduction classification, causes and prevention; safety rules and its necessity; safety on working place; safety equipment (Fire extinguisher, fire hydrant); causes of accident and its preventive measures; first aid and its importance first aid technique (circulating system and breathing system); care of tools; cleaning of working place; general maintenance; routine maintenance; trouble shooting; fault analysis and functional testing.

Workshop Practice: **Practical works based on Safety and Maintenance**

Trade : Foundry Practice

COURSE STRUCTURE

Sl. No.	Subject	Hours Per Course	
		Lecture	Workshop
01.	Sand Preparation and Mold Making	6	300
02.	Casting Processes and Furnaces	6	100
03.	Metal Melting and Alloying	6	00
04.	Pattern Making	6	30
05.	Engineering Materials	6	00
06.	Blue Print Reading	6	00
07.	Safety and Maintenance	6	00
08.	Heat Treatment	6	00
09.	Hand Tools & Measuring Tools	12	00
	Total	60	430
	Grand Total		490

Course Outline

Subject: Sand Preparation and Mold Making

Ingredients of mold and core making sand, sand, binders and additives, function of mold and core ingredients, mold making hand tools, characteristics of mold and core making sand, effect of sand size & shape, clay, moisture and other additives, mixing technique of sand ingredients, types of mold and core, pouring, gating system (runner, riser, sprue and gates) for mold, reinforcement of mold and core, function of core, chiller and chaplet. 1. steps involved in making a mold and core, different molding processes (green sand, dry sand, co: molding etc, pasting/setting of different mold components including core, different fettling processes, different casting defects due to molding sand and molding processes.

Workshop Practice: **Practical works based on Sand Preparation and mold making.**

Subject: Casting Processes and Furnaces:

Different types of casting processes-sand, gravity, semi-permanent mold, permanent mold, centrifugal casting, different types of melting furnaces pit/ crucible, cupola, rotary, tilting, induction furnace, feeding and solidification: solidification of metals and alloys, contraction stages and their implication in the provision of sound castings different casting; fluidity of molten metals, its necessity and influencing factors, methods used to minimize shrinkage and inclusion on castings, the design of running and feeding system for common cast metals and alloys, related calculations and sketching, defects due to casting processes and furnaces.

Workshop Practice : **Practical Works Based Casting Processes and Furnaces**

Subject: Metal Melting and Alloying

Different types of melting furnaces-pit/crucible, cupola, rotary, tilting and induction, different types of fuels-natural gas, biogas, hard coke, oil, electricity, preparation of raw materials for different furnaces estimation of raw materials, chronological adding system of alloying elements, fluxing of molten metal, pouring system of molten metal, different casting defects due to metal melting and alloying.

Subject: Pattern Making

Introduction to pattern and its importance, making a pattern lay-out, materials for making pattern, factors to be considered in pattern making, different types of pattern, different hand tools and machine tools used for making patterns, pattern materials and selection of appropriate materials, pattern allowances, casting weight estimation, core, core print and core boxes, pattern colors, preservation of patterns.

Workshop Practice : Practical Works Based on Pattern Making**Subject: Engineering Materials**

Introduction, classification of engineering materials: ferrous, nonferrous; polymer-plastic, rubber and fiber; ceramic and glass, composites; brief introduction on iron and steel: pig iron, wrought iron, gray cast iron, white cast iron, malleable iron, chilled cast iron, nodular cast iron, alloy cast iron, plain carbon steel and alloy steel; properties of metals: physical, mechanical (yield strength, ultimate tensile strength, breaking strength, compressive strength, fatigue strength, creep strength), chemical, thermal, electrical and optical properties; effects of alloying elements :carbon, silicon, manganese, sulfur, phosphorous, chromium, nickel, vanadium, molybdenum, tungsten and cobalt; manufacturing processes of metal components-casting, plastic working (forging, hammering, rolling, deep drawing, spinning), powder metallurgy, machining, welding and fabrication; Identification of metals: color, file, chips, spark, density, chemical analysis etc.

Subject: Blue Print Reading

Introduction to engineering drawing and its importance for engineers and technicians; Function of draftsman and designer; Types of drawings- component (part/ detail) drawing, collective drawing, sub-assembly drawing, general assembly drawing; Geometric drawing-straight line, angle, square, parallogram, polygon, circle, parabola, ellipse; Projection drawing-definition, classic function, orthographic projection (1st & 3rd angle projection), isometric projection and oblique projection; dimensioning: outside, inside, radius, angle, taper, tolerance; importance of auxiliary views, sectional views and hidden details; Conventional representation of components and symbols (nut, bolt, shaft, gear, welding, surface finish, materials, legend etc); different types of fits: clearance, transition and interference (shrinkage, expansion, pressure and force); meaning of: allowance, tolerance, upper limit and lower limit.

Subject: Safety and Maintenance

Introduction on safety and maintenance, its importance; fire classification, causes and prevention; safety rules and its necessity; safety on working place; safety equipment (Fire extinguisher, fire hydrant); causes of accident and its preventive measures; first aid; first aid technique (circulating system and breathing system); care of tools; cleaning of working place; general maintenance; routine maintenance; trouble shooting; fault analysis and functional testing.

Trade: Pattern Making

COURSE STRUCTURE

Sl. No.	Subject	Hours Per Course	
		Lecture	Workshop
01.	Pattern Making	6	334
02.	Sand Preparation and Mold Making	6	114
03.	Engineering Materials	6	00
04.	Blue Print Reading	6	00
05.	Safety and Maintenance	6	00
06.	Hand and Measuring Tools	6	00
	Total	42	448
	Grand Total		490

Course Outline

Subject: Pattern Making

Introduction, its importance, making a pattern lay-out: box, segment, solid, split, open joint and lagged pattern and core box equipment; study of basic joints: butt, face, corner, half-laps; methods of mounting pattern on plates; materials for making pattern, factors to be considered in pattern making, different types of pattern, comparison of various pattern making materials with regard to properties; construction and performance during manufacturing different hand tools and machine tools used for making patterns, pattern materials and selection of appropriate materials, pattern allowances, casting weight estimation, core, core print and core boxes, pattern colors, preservation of patterns.

Workshop Practice : Practical Works Based on Pattern Making

Subject: Sand Preparation and Mold Making

Ingredients of mold and core making sand, sand, binders and additives, function of mold and core ingredients, mold making hand tools, characteristics of mold and core making sand, effect of sand size & shape, clay, moisture and other additives, mixing technique of sand ingredients, types of mold and core, pouring, gating system (runner, riser, sprue and gates) for mold, reinforcement of mold and core, function of core, chiller and chaplet. 1. steps involved in making a mold and core, different molding processes (green sand, dry sand, co: molding etc, pasting/setting of different mold components including core, different fettling processes, different casting defects due to molding sand and molding processes.

Workshop Practice: Practical works based on Sand Preparation and mold making.

Subject: Casting Processes and Furnaces:

Different types of casting processes-sand, gravity, semi-permanent mold, permanent mold, centrifugal casting, different types of melting furnaces pit/ crucible, cupola, rotary, tilting, induction furnace, feeding and solidification: solidification of metals and alloys, contraction stages and their implication in the provision of sound castings different casting; fluidity of molten metals, its necessity and influencing factors, methods used to minimize shrinkage and inclusion on castings, the design of running and feeding system for common cast metals and alloys, related calculations and sketching, defects due to casting processes and furnaces.

Workshop Practice : Practical Works Based Casting Processes and Furnaces**Subject: Engineering Materials**

Introduction, classification of engineering materials: ferrous, nonferrous; polymer-plastic, rubber and fiber; ceramic and glass, composites; brief introduction on iron and steel: pig iron, wrought iron, gray cast iron, white cast iron, malleable iron, chilled cast iron, nodular cast iron, alloy cast iron, plain carbon steel and alloy steel; properties of metals: physical, mechanical (yield strength, ultimate tensile strength, breaking strength, compressive strength, fatigue strength, creep strength), chemical, thermal, electrical and optical properties; effects of alloying elements :carbon, silicon, manganese, sulfur, phosphorous, chromium, nickel, vanadium, molybdenum, tungsten and cobalt; manufacturing processes of metal components-casting, plastic working (forging, hammering, rolling, deep drawing, spinning), powder metallurgy, machining, welding and fabrication; Identification of metals: color, file, chips, spark, density, cheemical analysis etc.

Subject: Blue Print Reading

Introduction to engineering drawing and its importance for engineers and technicians; Function of draftsman and designer; Types of drawings- component (part/ detail) drawing, collective drawing, sub-assembly drawing, general assembly drawing; Geometric drawing-straight line, angle, square, parallogram, polygon, circle, parabola, ellipse; Projection drawing-definition, classic function, orthographic projection (1st & 3rd angle projection), isometric projection and oblique projection; dimensioning; dimensioning:outside, inside, radius, angle, taper, tolerance; importance of auxiliary views, sectional views and hidden details; Conventional representation of components and symbols (nut, bolt, shaft, gear, welding, surface finish, materials, legend etc); different types of fits: clearance, transition and interference (shrinkage, expansion, pressure and force); meaning of: allowance, tolerance, upper limit and lower limit.

Subject: Safety and Maintenance

Introduction on safety and maintenance, its importance; fire classification, causes and prevention; safety rules and its necessity; safety on working place; safety equipment (Fire extinguisher, fire hydrant); causes of accident and its preventive measures; first aid; first aid technique (circulating system and breathing system);care of tools; cleaning of working place; general maintenance; routine maintenance; trouble shooting; fault analysis and functional testing.

Trade : Electrical Maintenance

COURSE STRUCTURE

Sl. No.	Subject	Hours Per Course	
		Lecture	Workshop
01.	Electrical HouseWiring	12	35
02.	Electrical Machine	12	115
03.	Industrial Electronics	12	105
04.	Control System	12	105
05.	Measuring Tools/ Electrical Instrument	12	70
	Total	60	430
	Grand Total		490

COURSE OUTLINE

Subject: Electrical House Wiring

Introduction to electricity, safety precautions, electrical hand tools; introduction electrical wiring, classification of wiring, concept of battery wiring, rules and procedure of service entrance connection and its simple estimation; concept of service main, rising main, busbar trunking and simple lay out diagram of a single and multi: storied building/factory, connection procedure of megger, earth tester, types and procedure of joints; selection criteria of different sizes of wire and cables to specific purpose; concept of series, parallel and mixed circuit, characteristics and uses of series and parallel circuit application of main switch, switch board, distribution board (DB), sub-distribution board (SDB), different switches, holder, plug, socket, ceiling rose, cutout, and fuse and circuit breaker etc; connection of single: phase (1-0) energy meter and three- phase (3-Ø) energy meter to a CKT; types, importance and procedure of earthing, application of megger insulation tester for checking a complete circuit; overhead electrical line construction; installation of 11kv/0.44kv sub-station.

Workshop Practice: Practical works based on electrical wiring

Subject: Electrical Machines

Ohm's law, characteristics of resistance, specific resistance kirchhoffs law, right hand rule, Fleming's right hand rule and left hand rule, Faraday's law, Joule's laws, Lenz's law etc; concept of capacitor, inductor; introduction; types, construction and working principles of generator' parallel operation and trouble shooting of alternator; introduction, types, construction and working principle of single & three phase AC motor; synchronising procedure of alternator; construction and working principle of auto; transformer; transformer banking and its importance; wiring and layout plan of a given motor and window type air conditioner; discussion on starting & speed control of AC motor, difference between traditional and modern speed controlling system; testing and trouble shooting of single & three-phase AC motor; use of different types AC motor; types, starting system, speed control system, construction of dc motor, shortcomings and preventive measures of dc motor. importance of dc generator in the industry and power station; introduction, types, construction, working principle and uses of transformer, cooling system, losses and its testing procedure of transformer, discussion on current

transformer (CT) & potential transformer (PT) and its connection; objective of using of oil, characteristics of oil; design, construction and working principle of 1-turn and 2-turn AC & DC welding machine; introduction to inverter and its importance in the industry.

Workshop Practice: Practical works based on Electrical Machines

Subject: Industrial Electronics

definition, types and properties of semiconductor/ diodes/ resistor/ characteristics, use and testing procedure of forward and reverse system of diode; discussion on filter and half wave, full wave and three: phase rectifier, and bridge rectifier circuit; measurement and testing procedure of resistor /transistor; color code, 3-band, 4-band,5-band of resistor; discussion on FET and MOSFET; definition, types, properties and uses of SCR, DIAC, and TRIAC, integrated circuit (IC). discussion on logic gate (OR-gate, N[^]ND-gate, NOR- gate and inverter); introduction to auto-electronics, discussion on properties and uses of auto-integrated circuit, emergency lighting system and its circuit diagram, electronic fan, regulator and its circuit diagram, light dimmer CKT, musical calling bell and adapter circuit, computer, robot, television computer numerical control (CNC).

Workshop Practice: Practical works Based on Industrial Electronics

Subject: Control System

Different types of valve: directional valve, solenoid valve, flow control valve, hydraulic valve, hydraulic pump, motor; temperature control device: pyrometer, thermocouple, thermostat; hydraulic and pneumatic sequence circuit diagram; starting and closing of a motor on DOL S (direct on line starter); power circuit & control circuit; starting and closing of a motor on DOL S and inching method, power circuit, control circuit; forwarding, reversing and automation of the table of a milling on DOL S; starting and closing of a motor on star: delta Starter (manual & automatic). timer start/off method in power circuit & control circuit; double speed /cascade/ concatenation method; start and off method of a furnace /boiler by temperature control; single line diagram of power generation, transmission and distribution; introduction to different types of relay and protection of generator, transformer, line and equipment by CT, relay and circuit breaker; introduction to freeze and refrigerant and their classification; discussion on control diagram; introduction to air condition (AC) and its classification; discussion on window type, split type and central air conditioner.

Workshop Practice: Practical works Based on Control System

Subject: Measuring Tools and Electrical Instrument

Classification of measuring instrument; discussion on indicating, integrating, recording, instrument, various torque and effect on measuring instrument; extension of range of measuring instrument; installation, connection and uses of measuring instrument; star and delta connection system and relation between line voltage and phase voltage, line current and phase current; measurement of 10 /3-0 power by wattmeter method; measurement of current, voltage, frequency, power factor, power and energy of a given circuit; discussion on uses of different types of measuring tools.

Workshop Practice: Practical works based on Measuring Instrument and Tools.

Trade: Machine Maintenance

COURSE STRUCTURE

Sl. No.	Subject	Hours Per Course	
		Lecture	Workshop
01.	Machine Elements	06	124
02.	Mechanical Equipment	06	124
03.	General Mechanical Maintenance	14	200
04.	Blue Print Reading	06	00
05.	Hand Tools & Measuring Tools	07	00
	Total	42	448
	Grand Total		490

Subject: Machine Elements

Concept, classification, characteristics of machines; machine elements: base, frame, screw threads, springs, power transmitting device: gears, belt and pulley, chain and sprocket, shaft, spline, clutch, ratchet etc; seal: o-ring, gasket, oil seal etc; bearing: rolling, journal, bush type etc. bearing housing; pin: dowel, split, taper etc, key, hub, screw, rivet, washer.

Workshop Practice: Practical works based on Machine Elements

Subject: Mechanical Equipment

Pneumatic, hydraulic, different types of valve? pumps, motors, heater, cooler, filter, tank, pressure gauge, pipes and circuit diagram; power screw, chain, belt, gear, friction wheel coupling, linkage, cam, differential gearing; electrical and electronics: numerical control (NC), computerized numerical control (CNC).

Workshop Practice: Practical works based on Mechanical Equipment

Subject: General Mechanical Maintenance

Maintenance and maintainability concepts, catastrophic failure models, failure data analysis, maintenance methodology, objective, strategy, work planning and scheduling maintenance information systems, algorithm, development of maintenance, preventive maintenance, productive maintenance, total maintenance and condition for maintenance, maintenance record, purpose, and application.

Workshop Practice: Practical works based on General Mechanical Maintenance.

Subject: Blue Print Reading

Introduction to engineering drawing and its importance for engineers and technicians; Function of draftsman and designer; Types of drawings- component (part/ detail) drawing, collective drawing, sub-assembly drawing, general assembly drawing; Geometric drawing-straight line, angle, square, parallelogram, polygon, circle, parabola, ellipse; Projection drawing-definition, classic function, orthographic projection (1st & 3rd angle projection), isometric projection and oblique projection; dimensioning;

dimensioning:outside, inside, radius, angle, taper, tolerance; importance of auxiliary views, sectional views and hidden details; Conventional representation of components and symbols (nut, bolt, shaft, gear, welding, surface finish, materials, legend etc); different types of fits: clearance, transition and interference (shrinkage, expansion, pressure and force); meaning of: allowance, tolerance, upper limit and lower limit.

Subject: Hand Tools & Measuring Tools

Introduction to measurement, units and standards of measurement; types of measurement; different types of non-precision measuring tools: steel rule, measuring tape etc; different types of precision measuring tools, vernier calliper; micrometer, vernier micrometer, bevel protector, sine bar, gear tooth vernier; different types of gauges: height, filler, surface, telescopic gauges, use and care of measuring tools.

Trade : Welding Technology

COURSE STRUCTURE

Sl. No.	Subject	Hours Per Course	
		Lecture	Workshop
01.	Arc Welding	12	260
02.	Gas Welding	06	176
03.	Engineering Materials	06	000
04.	Blue Print Reading	06	000
05.	Welding Hand Tools & Measuring Tools	12	000
06.	Safety & Maintenance	06	000
07.	Heat Treatment	06	000
	Total	54	436
	Grand Total		490

Subject: Arc Welding

Introduction to arc welding, different types of welding processes: arc' gas, resistance etc; welding joints:butt, lap, corner and edge, welding positions, flat: Ig, horizontal-2g, vertical-3g, overhead-4g, pipe welding at horizontal position:5g, pipe welding at 45 ° in overhead position-(6g; welding design-v, u, fillet, square, j, bevel etc; arc welding equipment; basic principle of arc welding operation; welding parameter- amount of current, polarity, material, electrode size, and plate thickness; arc welding technique; arc welding electrodes and fluxes; welding design; defects in welds; welding jigs and fixtures; welding symbols; estimation of welding cost; advantages and disadvantages of arc welding; application of arc welding; troubleshooting of arc welding; inspection and testing.

Workshop Practice: Practical works Based on Arc Welding

Subject: Gas Welding

introduction to gas welding, classification of gas welding processes, gas welding equipment, basic principle of gas welding operation, gas welding technique, types of flame and its adjustment for gas welding and cutting, gas welding filler rods and fluxes welding design, defects in welds, advantages and disadvantages of gas welding, application of gas welding, troubleshooting of gas welding.

Workshop Practice: Practical works based on Gas Welding

Subject: Engineering Materials

Introduction, classification of engineering materials: ferrous, nonferrous; polymer-plastic, rubber and fiber; ceramic and glass, composites; brief introduction on iron and steel: pig iron, wrought iron, gray cast iron, white cast iron, malleable iron, chilled cast iron, nodular cast iron, alloy cast iron, plain carbon steel and alloy steel; properties of metals: physical, mechanical (yield strength, ultimate tensile strength, breaking strength, compressive strength, fatigue strength, creep strength), chemical, thermal, electrical and optical properties; effects of alloying elements :carbon, silicon, manganese, sulfur, phosphorous, chromium, nickel, vanadium, molybdenum, tungsten and cobalt; manufacturing processes of metal components-casting, plastic working (forging, hammering, rolling, deep drawing, spinning), powder metallurgy, machining, welding and fabrication; Identification of metals: color, file, chips, spark, density, chemical analysis etc.

Subject: Blue Print Reading

Introduction to engineering drawing and its importance for engineers and technicians; Function of draftsman and designer; Types of drawings- component (part/ detail) drawing, collective drawing, sub-assembly drawing, general assembly drawing; Geometric drawing-straight line, angle, square, parallelogram, polygon, circle, parabola, ellipse; Projection drawing-definition, classic function, orthographic projection (1st & 3rd angle projection), isometric projection and oblique projection; dimensioning; dimensioning:outside, inside, radius, angle, taper, tolerance; importance of auxiliary views, sectional views and hidden details; Conventional representation of components and symbols (nut, bolt, shaft, gear, welding, surface finish, materials, legend etc); different types of fits: clearance, transition and interference (shrinkage, expansion, pressure and force); meaning of: allowance, tolerance, upper limit and lower limit.

Subject: Hand Tools & Measuring Tools

Introduction to measurement, units and standards of measurement; types of measurement; different types of non-precision measuring tools: steel rule, measuring tape etc; different types of precision measuring tools, vernier calliper; micrometer, vernier micrometer, bevel protector, sine bar, gear tooth vernier; different types of gauges: height, filler, surface, telescopic gauges, use and care of measuring tools.

Subject: Safety and Maintenance

Introduction on safety and maintenance, its importance; fire classification, causes and prevention; safety rules and its necessity; safety on working place; safety equipment (Fire extinguisher, fire hydrant); causes of accident and its preventive measures; first aid; first aid technique (circulating system and breathing system);care of tools; cleaning of working place; general maintenance; routine maintenance; trouble shooting; fault analysis and functional testing.