

दक्षिणपूर्बरलवे / South Eastern Railway

मुख्यालय/ Headquarters:
कार्मिकबिभाग / Personnel Department
गार्डनरीच, कोलकाता-७०००४३
Garden Reach, Kolkata – 700043

No.SER/P-HQ/EE/JE(LDCE)25%/TM

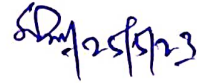
Dated.25.05.2023

To
The All Concerned
South Eastern Railway

Sub: Publication of Syllabus for the post of Junior Engineer/Track Machine, Level-6, 7th CPC against 25% LDCE , Level-6 (Centrally Controlled) in Track Machine organization, Civil Engineering Department.

The Approved syllabus for Selection to the post of Junior Engineer/Track Machine, Level-6 against 25% LDCE quota is circulated herewith for wide circulation amongst all prospective candidates.

Encl: Syllabus of Junior Engineer/Track Machine against
25% LDCE (14 Pages)

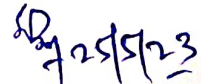


(Satyajit Roy)

Assistant Personnel Officer(HQ)
for. Principal Chief Personnel Officer

Copy to:

1. APO(Co-ord) for information and necessary action to publish the Syllabus for the post of Junior Engineer/Track Machine against 25% LDCE quota on the SER website at www.ser.indianrailways.gov.in.



for. Principal Chief Personnel Officer

(A) SYLLABUS OF TRACK MACHINE AND WORKING PRINCIPLE

- 1) Functions of Track Machine Organization Duties of SSE/TM (SD), SSE/JE/TM working on machines, SSE/JE Machine In-Charge, SSE/JE/MCM/TMM in control set up in HQ/ZMD/Division, SSE/JE (P. Way) deployed with the Machine.
- 2) Functions of Divisional Control, track machine control & Zonal HQ control in respect of Track Machines. Inspection Schedule of Track Machine Officials, Inspection Schedule of Open Line officials, Items to be inspected. Different types of track machines, important assemblies, rated progress, working Mechanism, symbols, circuit Diagrams.
- 3) Basic principles of working of different types of Track Machines Works required before, during & after deployment of track machines.
- 4) (a) Important assemblies of Tamping machines- Engine, Tamping Units, Tamping Tool, Lifting and Lining Unit, Satellite Unit, Brake System.
(b) Tampers without Satellite Unit, Tampers with Satellite Unit.
(c) Tamping Parameters- Squeezing Pressure, Tamping Depth, Tamping tool Vibration, Amplitude & Frequency, Vibration Pressure, Tamping Cycle & Squeezing Time, and Tamping Tool Surface Area.
(d) ALC –Automatic Guiding Computer System, Measuring Run (with ALC) Lining Mode and Levelling Mode.
(e) Lining System –Reference Rail, Lining Method , Working Principle of Lining, 4 point lining, 3 point lining.
(f) Levelling of Track – Datum Rail and Cant Rail.
(g) General Lift – Deciding General Lift, Quantum of General Lift, General Lift on Curves
(h) Works required before, during and after Tamping.
(i) Main features , main assemblies and components, Technical Data ,Power Transmission, Name of PCBs , their functions and Electrical System, Working Principles of 08-DUOMATIC/WST, 09-32-CSM, 08-275-2SUNIMAT, 08-275-3S UNIMAT , MPT, 08-275-4S UNIMAT, 09-3X TAMPING EXPRESS AND 09-3X Dynamic.
(j) Difference between 2S, 3S and 4S UNIMAT.
- 5) Dynamic Track Stabilizer (DTS) – Advantages of DTS, Brake System, Leveling System in DTS, Speed of Working of DTS, Stabilisation Achieved by DTS.
- 6) Ballast Cleaning Machine (BCM) – (a) Important Assemblies of Ballast Cleaning Machine (BCM)- Engine, Excavating Unit, Screening Unit, Conveyor System for Distribution of Ballast and Disposal of Muck. Track Lifting and Slewing Unit.(b) Types of Ballast Cleaning Machines(c) Working Principle and Capability of Ballast Cleaning Machines – Excavation Width, Excavation Depth , Lifting and Slewing of Track, Disposal of Muck, Screening Capacity of BCM, Controlled Ballast Distribution, Total Excavation , Deep Screening of Points and Crossings. (c) Works Required Before, During and After Deployment of Ballast Cleaning Machine.

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- (7) Shoulder Ballast Cleaning Machine (SBCM)- (a) Important Assemblies of Shoulder Ballast Cleaning Machine (SBCM)- Engine, Excavating Unit, Screening Unit, Conveyor System for Distribution of Ballast and Disposal of Muck, Ballast Profiling Plough, Broom, Brake System c) Capacity of Shoulder Ballast Cleaning Machines – Excavation Width, Excavation Depth , Muck Disposal System, Screening Capacity of SBCM. Works Required Before and During Block of Shoulder Ballast Cleaning Machine (e) Types of SBCM.
- (8) BRM- Important Assemblies of BRM –Shoulder Plough, Front Plough, Centre Plough, Hopper, Rail Fastening Sweepers, Brake System.
- (9) Rail Grinding Machine (RGM) – Purpose of Rail Grinding, Advantages of Rail Grinding.
- (10) Track Relaying Machines- Important Assemblies of Track Laying Equipment (TLE), Working Mechanism and Capability of Track Laying Equipment , Setting up of TLE Base Depot , Pre Relaying Operations-(a) At Base Depot (b) At Work site, Operations during Block, Post Relaying Operations, Track Relaying Train (TRT) – Functions of TRT , Advantages of TRT.
- (11) Important Units of AMECA T-28, Working Mechanism and Capability of AMECA T-28.
- (12) Utility Track Vehicle – General, Main Assemblies of UTV and their functions.
- (13) Rules for Movement and Block Working, Permissible Speed, Periodical Maintenance Schedule of Track Machines, CPOH, ZMD, Satellite Depot, Requirement of Man Power, Training & Roster, Procurement of consumables, components and spares.

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**(B) SUB:- SYLLABUS OF P.WAY ENGINEERING ,
ESTABLISHMENT, STORES & ACCOUNTS**

P.WAY ENGINEERING	
Track Technology	History of Railways, Zonal Railways Divisions and Production units.
	TT Organization on Indian railways, Organization at headquarters Divisional levels, CPOH and Bridge Workshop.
	Constituents of Railway Track. Requirements of Good Railway Track, Classification of Routes, Different Gauges, Functions, Types & Standard Rail Section, Standard length, Rolling marks & UTS.
	Formations in Embankment and Cutting. Sub-Grade materials and Track Drainage.
	Functions, Types & Sleeper Density, Requirements of PRC sleepers-their advantages and disadvantages.
	Rail to Rail fastenings and Rail to Sleeper fastenings.
	Functions & Specifications and Ballast profile.
	Functions & Important terminology, Constituents of Turnout.
	Types of switches and crossing and Switch Angle, Flange way clearance, Heel divergence and Throw of switch.
	Types of Crossings, Crossing number & Main constituents of Built-up Crossing, Standard Turnouts & permissible speed, Position of Sleepers at Points & Xing.
	Welding Terminology, Evil effects of Rail joints, Different types of welding.
	Development of Welded rails and Theory of Welded rails.
	Thermal forces in LWR and Permitted locations of SWR/LWR/CWR.
	Different Temperature Zones and De-stressing.
	Classification of Track Renewals, Factors governing rail renewal,
	General Instructions in IRPWM, Provisions on Regular Track Maintenance as contained in IRPWM.
	Provisions on Works incidental to Regular Track Maintenance with thrust on Deep Screening.
	Provisions on Maintenance of Track in Track Circuited areas as contained in IRPWM.
	Provisions on Maintenance of Track in Electrified Areas as contained in IRPWM.
	Precautions during Machine working.
	Categories of Engineering Works, Engineering Fixed Signals/Indicators: Temporary and Permanent,
	Emergency Protection of track: Single Line & Double Line, Detonators & Flare Signals.
	Necessity of curves, Types of curves.
	TTP, CTP & Transition lengths, Radius, Degree, Versine & field measurement.
	Super- elevation: Cant deficiency, Cant excess Cant gradient, Equilibrium cant and Negative Super-elevation.
	Gauge widening and Safe Speed on Curves.
	Different Track Parameters and Service tolerances.
	Different Schedules and Standard Dimensions.
	Loading Gauge and Over Dimensioned Consignment (ODC).
	Classification of ODCs and Introduction to various track machines.
Track Machines	Introduction of Track Machines in sequence.
	Functions and output of Track Machines.

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Introduction to IRTMM and RDSO TM Reports	Track Machine Organization & Duties of Operator & Technician, Rules for Movement & Working of Track.
	Machines Plannings, Operation & Monitoring of Track Machines, RDSO TM Reports.
Track Management System	Modular structure, Utilization of TMS, Administrators in TMS.
ESTABLISHMENT	
Leave Rules	Various types of Leaves, Eligibility etc.
Pass Rules	Various types of passes, Eligibility etc.
P.L. Bonus & GIS	Terms of Payments PLB, GIS Monthly subscription, Payment at retirement.
Allowances & Overtime	Various Types of Allowances & Eligibility.
P.F.	Meaning, Rate Withdrawal.
Pension Rules	Pension Rules.
DCRG	Amount of DCRG, Emoluments.
D&A Rules	Minor Penalties.
	Major Penalties.
Service Conduct Rules	Explanation and understanding of different Conduct rules.
	Manpower Planning & Training Welfare Measures in Railways, PNM, JCM & PREM.
Objectives and understanding of Various Acts	Minimum Wages Act, Factory Act, Industrial Dispute Act.
	Contractor Labour Act & Workmen Compensation Act.
HOER	Classification and Duty roster.
Awards	Different Awards.
ACCOUNTS	
Estimates	Definition & Necessity of Estimates.
	Kinds of Estimates & their Vetting.
Tenders	Different types of tenders.
	Power for Invitations of tender & NIT.
Railway Budget	Parliamentary Control over Railway Finance.
	Public Accountability, Canons of financial Proprietary.
	Railway Budget, Budgetary Terms, Budgetary Cycle.
	Demand of Grants, Expenditure classification, Works Programme.
STORE	
Introduction to Engg. Stores & Inventory Control	Stock Head of Accounts, Disposal of released and surplus materials.
	Indenting procedure, Issue note and Write-off statement.
	Stock verification and Inventory Control Technique.

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(C) (i) SYLLABUS FOR ELECTRICAL ENGINEERING

Fundamentals of Electricity	Symbols, Basic Concept of voltage and current, Ohm's law, Power law.
Electrical Components	Resistor: Definition, Unit, Symbol, Power Rating, Tolerance, Types, Resistor: Colour coding, Combination, Application, Faults & Troubleshooting.
	Capacitor: Definition, Unit, Symbol Types, Combinations, Application, Faults and Troubleshooting.
	Inductor: Definition, Unit, Symbol Types, Combinations, Application, Faults and Troubleshooting.
Auto Electrical	Battery: Definition of Cell & Battery, Types, Rating, Specific Gravity, Construction, Working of Lead-acid Cell & Battery, Maintenance, Testing by Hydrometer and Load tester.
	Alternator, Regulator, Construction, Working, Maintenance and Trouble-shooting.
	Self starter: Construction, Working, Maintenance and Troubleshooting.
	Relay: Definition, Construction & Operation, Types, Pin diagrams.
	Engine Circuit: Description, Function and Types.
	Safety Components, Faults & Troubleshooting.
	Z.F. Circuit: Description,
	Z.F. Circuit: Working, Safety Components, Sensors, Faults & Troubleshooting.
	Lighting & Safety circuits of different machine.
	Warning circuits of different machines.
	Locking and unlocking Circuit of different Machines.

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(C) (ii) SYLLABUS FOR ELECTRONICS ENGINEERING

Fundamentals of Electronics	Electronics Symbols and Nomenclatures, Fundamentals of Electronics and Applications ,Active components and Passive components.
Semiconductor Theory	Difference between Conductor, Semiconductor & Insulator. Properties of Semiconductor, Covalent Bonds, Energy Bands. Types of semiconductor, i.e. Intrinsic, extrinsic, (P-Type, N-Type).
Semiconductor Diode	Semiconductor Diode: Construction Working, Forward bias and Reverse bias, Voltage-Current Characteristics of P.N. Junction, Application of P.N. Junction Diode, Rectifier - Half wave & Full wave Rectifiers (Centre Tap and Bridge Rectifier), Polarity, Protection Device.
	Types of Diodes, Construction, Working Symbol and Application of Zener Diode, LED, Photo Diode, Opt coupler.
Transistor	Transistor, Construction, Description of Terminals, NPN & PNP, Transistor Mode of Connections, Amplifying function, Applications as Switch and Amplifier, Testing.
Transducer	Definition, Principle, Classification, Types, Tapping Depth Transducer, Function and Calibration.
	Lining and Measuring Transducer , Function and Calibration, Satellite Transducer, Hook Transducer, Function and Calibration.
	Pendulum, Height Transducer, Encoder, Function and Calibration.
	Height Transducer, Encoder, Function and Calibration.
Operational Amplifier	Definition of Operational Amplifier, Symbol, Function of each terminal, Open loop, Close loop, +ve feed back, -ve feedback, Characteristics.
	Application of Operational Amplifier as Buffer, Inverter, Non Inverter, Adder, Sub-tractor, Integrator etc.
	Operational Amplifier ICs used in different PCBs in machines and their Pin diagrams.
Digital Electronics	Number system i.e. Binary, Octal, Decimal, Hexadecimal, Logic Gates and Flip-Flop.
	Basic Idea of Microprocessor, Semiconductor memories, Multiplexer.
Electronic Circuits and PCBs:	Discrete Circuit & Integrated Circuit, Advantage & Disadvantage of PCBs used in different machines, Description, Name, Quantity and their Functions.
	Description of Data sender and data receiver PCB.
Power Supply:	Need of Power supply, Types of power supply, DC to DC Converter & Regulator.
	Functional description of Power supply PCBs EK 813SV, 812 SV, EK 816SV, Calibration, Testing & Troubleshooting.
	Functional description of Power supply PCBs, EK819SV, EK851SV , Calibration, Testing & Troubleshooting.
	812SV, EK 816SV, EK 819SV & EK 851SV.
Programmer unit and Logic	Function and Description of Programmer Unit, Description of EK552P, EK554P, Different Parts of Logic Plan, Description of different PCBs of Programmer Unit i.e. EK 501P, EK553P

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Plan.	Reading of Logic Plan and Input & Output of Programmer with the help of Logic Plan.
Multi-check/ Multiplexer PCB	Description of Multi-check PCB EK28V, EK207V Different measurements taken by Multi-check PCB.
Tamping Unit Control Circuit VPR/DUO/ CSM/3X and3X Dynamic /Unimat	Functional Description of Tamping Unit Control Circuit, Different Positions of Tamping Unit & their Description, Current of Proportional valve. Function and Calibration of Depth Selector and Depth Transducer. Functional Description of Tamping Unit control PCBs EK16V. Functional Description of Tamping Unit Control PCBs EK132V. Functional Description of Tamping Unit Control PCBs EK176V. Functional Description of Tamping Unit Control PCBs EK1AP7. Electronics Model Room for demonstration, testing, Trouble shooting and calibration of Tamping unit PCB.
Lining Control Circuit, VPR/DUO/ CSM/3X and3X Dynamic /Unimat	Functional Description of Lining Control Circuit and Input Potentiometer (Slew & Versine). Functional Description of Lining PCB EK349LV. Functional Description of Lining PCB EK335 LV. Calibration of Servo Valve, Transducers & Input Potentiometer. Basic concept of 3 Point Regulator / 3 Stage Regulator. Functional Description of EK2038LV. Functional Description of EK2173LV. Functional Description of Over-slew PCB EK290LV. Calibration of Lining PCBs and Troubleshooting.
Front Input Circuit: VPR/DUO/ CSM/3X and3X Dynamic /Unimat	Front Input Potentiometer, Slew, Versine, General Lift, Basic idea of ALC, GVA and Laser Lining, Calibration, Troubleshooting & Fault finding. Functional Description of EK2072LV Front Input Circuit. Functional Description of EK345LV Front Input Circuit. Functional Description of 09-3X Front Input Circuit. Functional Description of UNIMAT Front Input Circuit. Functional Description of 09-3X Dynamic Front Input Circuit.
Leveling & Lifting Control Circuit of VPR/DUO/ CSM/3X and 3xdynamic /Unimat	Functional Description of Leveling & Lifting Control Circuit, Transducers and Input Potentiometers. Functional Description of PCB EK347 LV. Functional Description of PCB EK346 LV. Functional Description of PCB EK2041LV. Functional Description of PCB EK2042LV. Calibration of Leveling & Lifting, PCBs and Troubleshooting.
Lesson- XVI Satellite	Functional Description of Satellite Control Circuit, Description of different positions of Satellite, Satellite Transducer, PCBs. Functional Description of Satellite Control PCBs EK24V.

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Control	Functional Description of Satellite Control PCBs EK202V.
Circuit:	Calibration of Satellite Control, PCB, Troubleshooting & Fault finding.
Work Drive	Functional. Description of. Work Drive Control Circuit.
Control Circuit:	Functional Description of PCBELT-5034.
	Functional Description of Work Drive PCB EK319LV.
	Functional Description of PCB VT-3005.
	Calibration of Work Drive PCB, Troubleshooting & Faultfinding.
Hook Control circuit	Functional Description of Hook Control Circuit and Transducer.
	Functional Description of Hook Control PCB EK120V.
	Functional Description of Hook Control PCB EK144V.
	Calibration of Hook Control PCB, Troubleshooting & Faultfinding.
Panel Boxes & Cable List	Main Panel Boxes i.e. Working & Engine Panel boxes, Cable list of different machines.

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(D) (i) SYLLABUS FOR HYDRAULICS & PNEUMATICS

Fundamentals	Introduction, Pascal's Law, Bernoulli's Theorem, Advantages of Hydraulic system,
Hydraulic Symbols	Hydraulic Symbols.
Hydraulic Oil	Functions and Properties.
Hydraulic Tank	Functions and Parts.
Hydraulic Filter	Functions, Types, Filtering material, Contaminants Control, Importance of filtration.
Hydraulic Hose and Fitting	Functions, Types, Hose specification: DIN, SAE & EN standards, Hydraulic Fittings, Precautions during mounting Hydraulic Hoses and Fittings.
Hydraulic Seal and 'O' Ring	Functions, Types, Seals materials, Precautions during providing hydraulic Seals, Causes of Failure.
Hydraulic Pump	Definition, Functions and Classification.
	Working and Construction of Vane pump.
	Practical disassembly and assembly of Vane pump.
	Working and Construction of Gear Pump.
	Working and Construction of Axial Piston Pump.
	Practical disassembly and assembly Axial Piston Pump.
	Precautions during mounting & Troubleshooting, Aeration & Cavitation.
Pressure Control Valve	Working and Construction of Relief Valve Troubleshooting.
	Practical disassembly and assembly of Relief Valve.
	Working and Construction of Un-loader valve, Troubleshooting.
	Practical disassembly and assembly of Un-loader valve.
	Working and Construction of Pressure reducing valve, Troubleshooting.
	Practical disassembly and assembly of Pressure reducing valve.
Direction Control Valve	Function and Types such as Spring centered valves; Spring offset valves.
	Practical disassembly and assembly of DC valve.
	Working of check valve, double check valve and Pilot Operated Check valve (POC).
	Practical disassembly and assembly of check valve, POC valve.
	Working of Logic valve (cartridge valve).
	Precautions during mounting of D.C. Valve and Troubleshooting.
Proportional and Servo Valve	Function and Troubleshooting of Proportional Valve.
	Practical disassembly and assembly of Proportional Valve.
	Function and Troubleshooting of Servo Valve.
	Practical disassembly and assembly of Servo Valve.
Flow Control Valve	Function, Types and Troubleshooting.
	Demonstration in model room.

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Accumulator	Functions, Types, Working of Bladder & Diaphragm Type Accumulator Charging.
Hydraulic Cylinder	Function, Types and Parts, failure analysis. Practical disassembly and assembly of hydraulic cylinder.
Hydraulic Motor	Definition, Classification of Hydraulic motor. Working of Vane motor, Gear motor. Working of Axial Piston motor. Mounting Precautions and Troubleshooting. Practical disassembly and assembly of vane motor, demonstration of Axial Piston motor.
Heat Exchanger	Function and Maintenance aspects.
Demonstration of Hydraulic Transparent Models	Hydraulic motors, D.C. Valves, Cylinder, Accumulators, Pressure Gauge etc. Pressure control valves, Flow control valves, Check Valve, Pilot Operated Check Valve etc.
Hydraulic Circuits	Introduction of different kinds of hydraulic circuits such as constant pressure, regenerating, closed loop circuit etc. Hydraulic circuits of 08-Duomatic, WST & VPR. Hydraulic circuit of 09-CSM. Hydraulic circuit of 09-3X. Hydraulic circuit of 3X dynamic. Hydraulic circuit of Unimat – 2S, 3S, 4S, MPT. Hydraulic circuit of BCM, SBCM, HOBCM. Hydraulic circuit of PQRS and T-28. Hydraulic circuit of BRM. Hydraulic circuit of DGS. Hydraulic circuit of TRT.
Demonstration of Hydraulic Equipment Sets	Demonstration of Hydraulic circuits using Fluid sim H Software. Work exercises. Demonstration of Hydraulic circuits using Fluid sim H software. Work exercises.
Pneumatic Symbols	Pneumatics symbols and Application of air on Track machines.
	Working and maintenance of Air compressor, Cooling coil, Safety valve, Air dryer, Water separator and Air oiler. Working and maintenance of DC Valve, KE Valve, Cylinder and Pneumatic hoses.
Pneumatic Circuits	Pneumatic Working circuits. Pneumatic Brake circuits.



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D (ii) SYLLABUS FOR MECHANICAL ENGINEERING

Power Transmission	Mechanical Transmission, 'V' belt, Chain, Pulley, Cardon Shaft.
Gear Box and Clutch Assembly in UNO/DUO	Working, Construction and Maintenance practices of Main gear box and Clutch assembly.
	Working, Construction and Maintenance practices of Reversing gear box and Six speed gear box.
Distributor Gear Box	Working, Construction and Maintenance practices.
Driving and Running Axle	Function, Parts and Maintenance aspects, setting of crown & tail pinion.
Z.F. Hydro-Dynamic Gear Box	Function and Construction.
	Precautions during working and Maintenance aspects.
	Failure Analysis and Troubleshooting.
Funk Gear Box	Working, Construction and Maintenance practices.
Reduction Gear Box	Working, Construction and Maintenance practices.
Satellite Axle Gear Box	Working, Construction and Maintenance practices.
	Precautionary steps to avoid failure.
Tamping Unit	Function, Non-synchronous tamping principle and specifications.
	Function and Parts of tamping unit of 09-CSM,
	Function and Parts of tamping unit of 09-3X.
	Function and Parts of tamping units of Unimat-3S, 4S.
	Dimensions of different Parts and Tolerances, setting of bearings and spacers on vibration shaft.
	Maintenance schedule, Precautions during working & repairing
	Failure Analysis and Troubleshooting.
Lifting and Lining Unit	Function, assembly and maintenance aspects.
Bearings	Functions, Types, Bearing Clearance and Maintenance aspects.
BCM Assemblies	Working, and Construction of Excavation unit.
	Maintenance practices of Excavation unit.
	Working and Construction of Conveyor Belts and Screens.
	Maintenance practices of Conveyor Belts and Screens.
Lubrication	Oil and Lubricants used in different gear boxes,
	Tamping unit, Lifting unit, Screen -drum etc., types and their capacities.
Lesson-XIV: Maintenance Schedules	Maintenance Schedules of Tamping machines.
	Maintenance Schedules of Non-tamping machines.
	IOH/POH of machines.

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(E) (i) SYLLABUS FOR I.C. ENGINE ENGINEERING

General	I.C. & E.C.Engine Advantages and disadvantages.
	Classification of I.C. Engine, Main Systems of I.C.Engine.
Constructional Details of Engine	Cylinder, Cylinder head, Piston and Piston rings.
	Connecting rod and Crank shaft.
	Fly wheel, Cam shaft, oil Sump Inlet and Exhaust valve.
	Push rod, Rocker arm, Valve clearance, Valve operating mechanism.
Basic Terminology	T.D.C., BDC, Swept volume, Clearance volume, Stroke length, Cylinder bore, Compression ratio.
Working Principle of I.C. Engine	Working Principle of 2 Stroke Diesel Engine, 4 Stroke Diesel Engine (Diesel cycle).
	Working Principle of 2 Stroke Petrol Engine (Otto cycle).
	Working Principle of 4 Stroke Petrol Engine (Otto cycle).
	Actual Working cycle of 2 Stroke Diesel Engine (Diesel cycle).
	Actual Working cycle of 4 Stroke Diesel Engine (Diesel cycle).
	Actual Working cycle of 2 Stroke Petrol Engine (Otto cycle).
	Actual Working cycle of 4 Stroke Petrol Engine (Otto cycle).
	Deviations between Actual Working cycle and theoretical cycle.
	Firing Order of all engines provided on track machines, Combustion of Fuel.
	Valve timing diagram, Importance of tappet setting.
	Power flow in multi cylinder engine.
Air Supply system of Diesel engine	Requirement of Air, Types of Air cleaner.
	Cleaning and checking of Dry type Air cleaner.
	Cleaning and checking of Oil Bath type filter.
	Draw backs of choking of Air Cleaner.
	Working principle of Supercharger.
	Working principle of Turbo charger.
	Importance of After cooler.
Fuel Supply system of Diesel Engine	Functions Fuel supply system, Classification of Fuel supply system.
	Block diagram of fuel supply system, Working principle of Fuel Injection Pumps.
	Working principle of Injectors and Filters.
	Working principle of Mico Bosch Fuel supply system.
	Working principle of Cummins PT Fuel supply system.
	Difference between Mico Bosch and Cummins PT Fuel supply system.
	Calibration of MICO Bosch Fuel supply system.
	Calibration of Cummins Fuel supply system.




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Lubricating System of Diesel Engine	Concept of lubrication, Functions of Lubricating oil, Properties of Lubricating oil, Oil Additives.
	Viscosity rating.
	Lubricating circuit of an engine, Different types of Lubricating systems.
	Working principle of Oil pump and Relief Valve.
	Importance of Lube oil filters.
	Importance of Oil cooler.
	Importance of Oil pressure Gauge and crank case Ventilation.
Cooling system of Diesel Engine	Necessity of Cooling, Different methods of Engine cooling.
	Air Cooling system.
	Water Cooling system.
	Difference between Air and Water cooling.
	Drawbacks of over cooling, Reasons for overheating.
Maintenance Schedule Maintenance Steps	Maintenance Schedules of Cummins Engine.
	Maintenance Schedules of Deutz Engine.
	Maintenance Schedules of MWM Engine.
	Maintenance Schedules of Kirlosker Engine.
	Maintenance Schedules of QST 30 Engine.
	Precautions in providing Piston ring on Piston.
	Assembly of Cylinder liner.
	Adjustment of Injection timing & Valve (Tappet) clearance.
	Testing of Nozzles, Inspection of Crankshaft.
	Symptoms of Troubleshooting of Cummins Engine.
	Symptoms of Troubleshooting of Deutz Engine.
	Symptoms of Troubleshooting of MWM Engine.
	Symptoms of Troubleshooting of Kirlosker Engine.
	Symptoms of Troubleshooting of QST 30 Engine.
	Setting of torque wrenches, Tightening torque of different engine assemblies.
	Clearance of moving parts.
	Failure analysis of Cummins Engine.
	Failure analysis of MWM Engine.
	Failure analysis of Deutz Engine.
	Failure analysis of Kirlosker Engine.
	Failure analysis of Engine QST 30.


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E (ii) SYLLABUS FOR WORKSHOP TECHNOLOGY

M&C Training	Manufacturing of Iron & Steel.
	Shaping of Metals & Alloys.
	Classification of Steel on the basis of percentage of Carbon.
	Micro- constituents of Iron and Steel & Carbon Steel.
	Alloy Steel & Cast Iron.
	Physical Metallurgy.
	Mechanical properties of Cast Iron, Steel & Non Ferrous Alloy.
	Heat Treatment: Hardening, Tempering Annealing.
	Normalizing, Case Hardening Nitriding.
	Inspection and testing of Materials for property evaluation.
	Introduction to various standards: IRS, SAE, DIN, ISI, BS etc. and Acceptance Criteria.
Smiting and Forging	Forging Materials, Heating Devices.
	Forging Temperatures, Smith Forging Operations.
	Forging Processes: Hand Forging, Power Forging.
Welding and Related Processes	Types of Welding and Metallurgy of Welding.
	Gas Welding, Oxy-acetylene and Air-Acetylene.
	Arc Welding and Resistance Welding.
	Related Processes: Soldering, Brazing etc.
	Procedure for welding of tamping tool and defects in Tamping Tool welding.
	Welding of BCM turret gears, main links, intermediate links and cutter bar and grinding Operation.
Bench Work and Fitting	Various Tools and their uses and Bench work.
Measurement and Inspection	Standards of Measurement, Linear Measurement.
	Classification of Measuring Instruments, Comparators and Measuring Machines.
	Angular and Taper Measurements.
	Demonstration in Model Room.
Limits, Fits and Surface Quality	Interchangeability, Limits, Fits, Allowances, Tolerances and Surface finish.
Workshop Machines	Lathe Machines, Different Lathe Machine Operations.
	Drilling machine and Boring Machine.
	Shaper machine and Planner machine.
	Slotting machine and Grinding Machine.
	Milling Machine, Gear Cutting Machine.
	Jigs & Fixtures, Presses.
	Broaching machine, Sawing Machine.
	Workshop visit.
Threads	Threads (Use and Applications), Different types of threads.
Quality Control	Statistical Quality Control, Control Charts and their application.

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