EAST CENTRAL RAILWAY

ELECTRICAL DEPARTMENT

Written Examination

Limited Departmental Competitive Examination (LDCE)

For AEE (30% Group B)

Date: 30Aug 2009 **Paper 2** Maximum Marks 150

The questions are descriptive, numerical or short answers. The model answers are for general guidelines and evaluator may consider the experience of the candidate when expressed with logics. In many questions, the answer may go beyond the model answer and therefore, evaluator may consult the relevant manual if required.

Following corrections were advised during the examination

Part I Question 1: --------two/three lines on any of five equipments

Part I Question 9: Question in Hindi language should be corrected to give five features ~~and~~ four features.

PART I

Attempt any 4 questions

1	Refer page 3 of vol 1 of Maintenance Manual of CLW for WAP4 class of locomotive. Description is at para 1.1 to 13 at Page 32 of the said manual. The candidate may give the description in brief. Major equipments are Pantograph, VCB, Current Transformer for QLM, Tap Changer, Transformer, RGR, CGR, Rectifier panel, etc. and candidate may give idea about the purpose and relevance of the equipment.	20
1.1	Q44 relay is called time delay relay of 0.6 sec. and provided in the locomotive to monitor the step by step progression of tap change. If tap changer sticks in between notices, locomotive trips within 0.6 secs. This is a most important relay for safety of locomotive towards tap changer sticking up and likely fire. The candidate may explain with simple circuit diagram.	5
2	Complete Air circuit is given at Br.14of Vol II of Maintenance Manual. The candidate may explain Main reservoir line of 10 Kg. Major equipments are Compressor, after cooler, Pressure Governor, Air Drier, Automatic Drain valve, non return valve, reservoir etc.	20
2.1	Airflow	5
3	Train Resistance: 4800x1.35=6480kg Locomotive Resistance: 125x3=375kg Grade Resistance: (4800+125)x1000/200=24625Kg Curve Resistance: 0.4x2x(4800+125)=3940Kg Total Resistance or Tractive Effort: 6480+375+24625+3940=35420Kg Rail Horse Power: 35420x50/270=6559HP Step marking should be considered based on the understanding and effort made by the candidate.	20
3.1	Write measures to prevent wheel skidding through maintenance and driving techniques. Wheel skidding is caused when braking effort is more than adhesive weight. Braking effort can be reduced by correct setting of brake cylinder (direct or automatic through BP) i.e. setting of C3W valve, BC piston stroke etc. Loco pilot should press PVEF paddle to prevent loco brake application, use of sander on down gradient if loco brakes are applied fully, and avoid controlling train by loco brake except emergency.	

4.	a)Name all the auxiliary motors provided on WAG7 class of locomotive and their role MVMT-Traction Motor cooling blower; MVRH-Transformer Radiator cooling blower motor, MPH- Oil pump motor for transformer, MVSL-Smooting Reactor blower motor, MVSI-Rectifier cooler blower motor. MCP-Compressor motor MVRF-RB cooling blower motor. MCPA-Auxiliary Compressor Motor and ARNO for conversion of Single phase into three phase b)Describe wheel wear and different type of defects and measures taken to improve wheel life Wheel defects are given at 4.3.7 Page B-44 of Vol II (Four defects explaining is enough) Wheel profile Flange, Root wear limit may be given Methods to improve life is given at 4.3.6 Page B-43 of Vol II- The candidate may explain use of intermediate wheel profile, prevention of full loco wheel turning when only one or two wheel wear has reached condemning limit by wheel changing and turning only one bogie, proper adjustment of brake rigging to prevent biting at root etc. c) Describe basic steps for over hauling of an equipment explaining role of must change items Basic steps are Check history, dismantle by keeping must change items and non-changing items in separate bucket. Clean non changing items and examine for any damage, wear etc. Return the must change items to Supervisor and take the new kit. Replace damaged and worn out items of non-changing item with the knowledge of supervisor. Assemble the items. Keep on testing sub assemblies to avoid frequent opening and closing, Test the assembly by air, vacuum, light run, etc for any leakages, abnormal sound etc. attend and make final assembly. Test final. Paint. Give number and packing in a Polythene bag to prevent dust/moisture absorption.	
4.1	What are the checks conducted by Loco Shunter before taking over the Locomotive from sheds and general nature of defects identified by him. Shunter checks the locomotive on behalf of Loco pilot. All item in cab (gauges, lights, FL, HL, seat, wiper, look out glass, horn), BP/FP hose pipes, oil level, sander working, air or oil leakages and general round of inside locomotive etc. General defects observed by him oil deficient/leaking, sander not working, cab not cleaned, grating dangling etc. Candidate may given explain with his practical experience.	
5	An approximately 5 Km siding is planned for electrification with standard OHE design. Assess quantity for minimum 8 major cost items. Make presumption of a plan and draw the same before assessing the quantity. This is given at Page 102 of IRIEEN Manual Vol I Treatise on Electric Traction Distribution. A photo copy attached.	
5.1	What to you understand by Tramway type of OHE, its limitation and relevance for cost reduction? It is given at page 137 of IRIEEN Manual Vol I Treatise on Electric Traction Distribution. A photo copy attached	
6	Draw schematic connection diagram of 132/25kV TSS from 132kV line with feeding station upto double line OHE. It is given at page 200 of IRIEEN Manual Vol I Treatise on Electric Traction Distribution. A photo copy attached. Five major equipments are Traction Transformer, Circuit Breaker, Current Transformer, Potential Transformer, Lightening Arrestor, protection in 132kV and 25kV circuit.	

6.1	What are the natures of faults on the catenary system? What type of relays provided for protection towards such fault? Faults on the overhead equipment can be mainly of three types: 1. Earth Fault 2. Overloads and 3. Faults due to incorrect switching operation Relays provided are: 1. MHO relay 2. Wrong phase coupling protection relay 3. Instantaneous over current relay 4. Delta-1 type high resistive fault selective relay 5. Panto flashes over protection relay 6. Under voltage protection of neutral section. It is given at page 229-32 of IRIEEN Manual Vol I Treatise on Electric Traction Distribution.	
7	Write salient features of Traction Transformer. Ratings, different sub assemblies, Protective relays and essentials of maintenance It is given at page 331-333 of IRIEEN Manual Vol I Treatise on Electric Traction Distribution. A photo copy attached	15
7.1	What is a neutral section, its need and precautions to be taken for its location? It is given at page 212 of IRIEEN Manual Vol I Treatise on Electric Traction Distribution. A photo copy attached	10
8	Write short note on any 5 of the following (Each carry 5 Marks)	25
8.1	Booster Transformer Para 2.9.7 page 343 Vol I of the IRIEEN manual attached for guidelines.	
8.2	Guidelines for electrification of Petroleum sidings Page 175 of VOL II of IRIEEN Manual	
8.3	Guidelines for setting of parallelogram type Distance protection. Available at page 251 of IRIEEN manual Vol I Photocopy attached for guidelines. This is a very detailed answer and the candidate may explain only the concept.	
8.4	Precautions during Power Block Power block is taken whenever any maintenance activity is performed on any of the equipment charged to potential or which are nearby. Precautions are necessary for the safety of the workman. Power block is granted by TPC and private number is exchanged by the site supervisor with TPC. Section is earthed by earthing rod to avoid any accidental energisation of OHE. The candidate may explain on these lines the procedure followed.	
8.5	Causes of Mid section failure of Tower Wagon. This is as per the experience of the supervisor and main causes are burning of self started, electrical fault in control circuit, brake system, heavy leakage in brake system, choking of fuel pipe line etc.	
8.6	List most important tools and plant of Tower Wagon This is as per the list available in ACTM copy attached.	
9	Explain refrigeration Cycle. How an air conditioner can work in cooling as well as heating mode? What precautions are taken while installing a split type AC? Write 5 important features that are provided in microprocessor based split ACs Answer for first two parts is attached which is in very detail and the candidate may only give the concept. Indoor Unit: Wiring and convenient refrigerant piping, air flow towards most used space Outdoor unit: Space from fixed structure, no obstruction in through of hot air, no direct sun light, aesthetic building not affected Remote control of temperature , Air flow speed, air flow direction, jet cool, sleep mode timer etc.	20
9.1	What refrigerants are provided in AC coaches? Why there is a need for change over for	5

	earlier type? R134a (Chemical name$H_2FC\text{-}CF_3$ 1,1,1,2-Tetrafluoroethane) Underslung coaches were using R12 (Dichlorodifluoromethane) gas which causes environmental hazard of ozone layer depletion therefore getting banned.	
10	Attempt any five of the following	~~20~~
10.1	Write minimum 5 essential protections for submersible pump for its reliable and safe working. Overload, under load (dry run), single phasing (incoming and load side), over current (short circuit), earth fault (loss of insulation)	
10.2	Write selection criteria of the rating of a submersible pump? Yield test is done before selection of any pump. Head is calculated and HP is worked out based on the yield in Quantity and Head.	
10.3	What are the main causes of heavy smoke from a diesel Engine Take given	
10.4	What are the recent developments in the field of Electric lamp and the role it can play in containing energy bill without compromising on illumination level? Energy efficient lamps have been introduced such as T5-28W lamp with electronic choke, CFL lamp of 11W, 14W, LED etc. Luman/watt of these lamps are in the range of 60-100lumen/watt and available in lower wattage. These lamps are now finding application for all types of illumination work. The candidate may explain on these lines.	
10.5	What do you understand by Load Factor? What is its role in Energy Bill? Load factor is actually gives the idea of load distributed over the 24 hrs period. Load generally non-uniform and graph is plotted to assess the maximum demand. Contractual demand is assessed based on this graph. The power utility charges minimum demand charges based on CD (some utility company charges based on the maximum demand during the period). Effort should be increase load factor by distribution of load and thus revising the CD. Penalty is also imposed for exceeding CD.	
10.6	Why a Capacitor is required to start a house hold fan? Explain with diagram. How the recent design of fan regulators works? Capacitor is required for splitting single phase in two phases as two phases are essential for an induction motor to start. The candidate may explain a diagram for starting of a single phase motor. Voltage control by inserting resistance was the practice followed earlier which has now given way to inductor and electronic type which controls the voltage without wasting energy. Electronic types are based on controlling input voltage by using TRIAC, MOSFET etc. The advantage is energy efficiency.	
11	Explain with Block diagram working of 25kVA coach inverter. What are the protections provided for internal and external fault? 25kVA inverter is provided to convert 110V DC into three phase 415 AC for powering RMPU. Details are attached.	
11.1	What do you understand by ERRU? Draw its block diagram. Write important data logged and its advantage in evaluating the performance of coach? ERRU is called Electronic Rectifying Regulating Unit an improved version of RRU. Details are attached. It has the advantage of knowing net charging and discharging current, voltage regulation, load balancing of alternator, over generation protection etc.	
12	Write short note any five of the following	
12.1	BLDC fan: Note attached	
12.2	LED base emergency light for coach: Note attached	
12.3	Causes of Fan belt dropping. Candidate may give his experience. Most of the common reason for belt falling are belt slipping due to less tension, mis-alignment, less number	

	of belts, over aging, poor quality, coming out of the groove during braking or acceleration due to defect in tensioning device.	
12.4	Important checks during C Schedule of a coach Attached CESE to qme	
12.5	Essential Spares and tool for ACCI Attached	
12.6	Suggest measures for prevention of AC coach failure. AC failures are very sensitive and cause for passenger dis-satisfaction. Preventive measures are certainly important to be taken care during POH and pit maintenance but following is important: 1. No equipment should be isolated from base depot 2. Train passing staff and ACCI should be trained in available redundancy of equipment and running the AC system satisfactorily in case of failure of any one. There are two RMPUs each with two compressor, two numbers of Alternator, 25kVA inverter etc. and failure of one should not cause AC failure and staff should now the isolation 3. Availability of tools with ACCI so that isolation can be done 4. Bypassing of defective battery 5. Manual operation of field for alternator in case of failure of RRU/ERRU 6. There is no alternative for failure of evaporator motor; and half coach Non AC is unavoidable 7. For under-slung AC coaches, the redundancy do exists but in two separate Units.	
13	Answer any **five** केवल पाचें का उत्तर लिखें	25
13.1	Anti-theft measures may defined as an action to prevent theft of Railway assets located which are not manned. The actions involved 1. Change of design such that the residual value is meaningless for a miscreant 2. Hiding the item such that it is not visible and avoidance of temptation 3. Damaging the threads so that it should not be possible to remove the item The candidate may explain on these lines	
13.2	Regenerative Breaking This type of braking is used in WAG9,WAP5and7 class of locomotive in which traction motor works as generation during braking converting mechanical energy into electric energy and feeding back to traction system. About 15-20% energy regeneration is possible in any haul of freight train due to normal braking required in a run.	
13.3	Dissolved gas analysis, or DGA, is a diagnostic and maintenance tool used in machinery. The study of gases from transformers can be used to give an early indication of abnormal behavior of transformer and may indicate appropriate action that may be taken on the equipment before it suffers great damage. The DGA as a maintenance tool must become a part of the routine practice in the industry There are four basic types of faults, which can occur in the transformer: • Arcing or high current break down • Low energy sparking or partial discharges. • Localized overheating or hot spots and • General overheating due to inadequate cooling or sustained overloading Each of the fault result in thermal degradation of the oil either alone or in combination with paper insulation. This gives rise to the evaluation of various hydrocarbon gases,	

	hydrogen and oxides of carbon, in quantities depending on the type of fault. • Heavy current arcing is characterized by the evolution of significant quantities of hydrogen and acetylene (C2H2). If the arcing also involves paper insulation, the oxide of carbon will also be present. • Partial discharge usually results in evolution of hydrogen and lower order hydrocarbons. • Localized heating or hot spot gives rise to methane and ethane in appreciable amount. • Prolonged overloading or impaired heat transfer can cause CO and CO2 to be generated due overheating paper insulation. To ensure uninterrupted and economical supply the trouble free performance of vital electrical equipments like power transformers during service is a matter of great importance. They are often subjected to complex environmental condition and variable thermal and electrical stresses. Efforts have been made to assess the health of the transformer during service through a series of diagnostic tests. Major Emphasis of these diagnostic tools is to detect the incipient fault prior to their developing into major faults which has obvious advantages. Candidate may explain on these lines.	
13.4	Crew Management System : Details from CRIS attached	✓
13.5	SEC in Electric Traction and others SEC is Specific Energy Consumption and define as Energy Consumed per 1000GTKM(Gross Ton Kilometer) and Energy Consumed per connected load in non-traction. It is indication to assess proper utilisation of energy. Candidate may explain on these lines	
13.6	Criteria for Electrification of a section High traffic density, extension of an electrified route on short spur and passenger commuter section. Advantage of electric traction of low energy cost, high horse power thus less number of locomotive, lower line haul cost gives a return of 14% and above after a particular level of traffic density is achieved.	

PART II
Establishment

1	Answer any five of the following Indian Railway Establishment Code Vol.1 and II may be referred	
1.1	What are different passes issued to Railway staff? CL, LAP, LHAP, Maternity, Paternity, Study,Extraordinary	
1.2	What are the different types of leaves admissible to Railway staff Duty, Privillage, school,post retirement, special passes (Medical,sports,scouting etc)	
1.3	Encashment of Leave 300 days at the time of retirement and 10 days in two years and five times in service	
1.4	Procedure for taking minor penalty disciplinary action	
1.5	Compassionate Appointment	

1.6	PNM पी एन एम	
1.7	HOER एच ओ ई आर	
2	Answer any **five** केवल पाचें का उत्तर लिखें	25
2.1	Liability Register देयता रजिस्टर	
2.2	SOP एस ओ पी	
2.3	Pink and LAW book पिंक एवं ला बुक	
2.4	Stock and Non-stock Item स्टाक एवं नान स्टाक वस्तुयें	
2.5	Audit Para आडिट पैरा	
2.6	Revised estimate and material modification संशेधित एस्टीमेट एवं मेटिरयल आशेधन	
2.7	Important checks by AEE before passing a contractor's bill against a works contract कार्य सविंदा में ठेकेदार के बिल को भुगतान करवाने के लिए एईई द्वारा क्या क्या महत्वपूर्ण चैक किये जाते हैं ?	
2.8	Important checks before a proposal is submitted for financial vetting किसी भी योजना को वित्तीय पुनरीक्षण करवाने से पहले क्या क्या चैक किये जाते हैं ?	