

DEPARTMENTAL EXAMINATION

DEPARTMENTAL TEST FOR THE TECHNICAL OFFICERS –FIRST PAPER.

ANSWER KEY

Question number	Answer	Reference
1. (i)	(c) Open access.	Electricity Act 2003. Page:6
(ii)	(b) Bangaluru	Electricity Act 2003. Page 18/ GI question.
(iii)	(a) < 6 months	Electricity Act 2003 Page:25
(iv)	(a) < 30 days	Electricity Act.2003. Page: 58
(v)	(c) ≤ 2500 .	Electricity Act 2003 Page:66
(vi)	(c) ≥ 1 MW	Distn code: Page: 196
(vii) ✓	(c) less than 3 ma ✓	Code of technical instruction Page:208 ✓
(viii)	(b) 18.6KW	Distn code: Page: 202
(ix)	(c) 400 KV system	Grid Code. Page : 23
(x) ✓	(c) 12 KV	Code of Technical Instructions Page no:391 ✓
(xi)	(a) Metal oxide	Grid Code: Page: 23
(xii)	(a) 10%	Tender Regulations 1991 / Page No: 15
(xiii)	(a) 1%	Tender Regulations 1991 /. Page No: 16
(xiv) ✓	(c) DC	Code of Technical instructions: Page.9 ✓
(xv) ✓	(a) Ampere hour	Code of Technical instructions: Page:9 ✓
(xvi) ✓	(a) Hydro meter	Code of Technical Instructions Page:11 ✓
(xvii) ✓	(b) DGA	Code of Technical instructions Page : 83. ✓
(xviii) ✓	(a) 2	Code of Technical Instructions Page:11 ✓
(xix) ✓	(a) 1.85 Volt	Code of Technical Instructions. Page: 17 ✓
(xx) ✓	(a) Trip	Code of Technical Instructions Page: 63. ✓
2 (i) ✓	(a) Acetylene	Code of Technical instructions Page: 89 ✓
(ii)	(a) 4	TNEB Volume Page: 95
(iii) ✓	(a) Tan δ	Code of Technical Instructions Page:124 ✓
(iv) ✓	(a) RTU (Remote Terminal Unit)	Code of Technical Instructions Page: 310 General question. ✓
(v) ✓	(a) Silicon	Code of Technical Instructions Page:178 ✓

(vi) ✓	(b) 0.3	Code of Technical Instructions Page: 410
(vii) ✓	(a) Twice	Code of Technical Instructions. Page:373. ✓
(viii)	(a) 6	TNEB manual. Page 70
(ix)	(b) full	TNEB manual P: 395
(x)	(d) 10 feet and 9 inches	Safety manual. Page: 15
(xi)	(a) 20 crores	Delegation of powers TOIGI page:16
(xii) ✓	(a) 30°	Code of Technical Instructions. Page:83
(xiii)	(b) State coordination forum	Grid code Page: 14.
(xiv)	(a) Back up	Grid code: 38
(xv)	(a) 160	Grid code Page: 39
(xvi)	(b) 360	Grid Code: Page: 46
(xvii)	(a) 49.0	Grid code. Page:47
(xviii)	(c) Buckling	Code of Technical Instruction. Page:22 ✓
(xix)	(d) 1520 M ²	Distn Code: Page:204
(xx)	(d) 90	Distn Code: Page: 5
3 (i) ✓	<p><u>Duties and functional responsibilities of the Regional Load Despatch Centre (RLDC) [Electricity Act 2003 / Page: 18 & 19] mark:5.</u></p> <p>1. The Regional Load Despatch Centre shall be the apex body to ensure integrated operation of the power system in the concerned region.</p> <p>2. The Regional Load Despatch Centre shall comply with such principles, guidelines and methodologies in respect of the wheeling and optimum scheduling and dispatch of electricity as the central commission may specify in the Grid Code.</p> <p>3. It is responsible for optimum scheduling and dispatch of electricity within the Region, in accordance with the contracts entered in to with the licensees or the generating companies operating in the region.</p> <p>4. Responsible to monitor the grid operations.</p> <p>5. The RLDC is to keep accounts of the quantity of electricity transmitted through the regional grid.</p> <p>6. The RLDC is to exercise supervision and control over the interstate transmission system.</p> <p>7. Responsible for carrying out real time operations for grid control and dispatch of electricity within the region through secure and economic generation of the regional grid in accordance with the grid standards and the grid code.</p>	
(ii)	<p><u>Grounds for rejecting a Tender [Tender regulations 1991.]Page:25./ mark:5</u></p> <p>Tender shall be rejected if it is,</p> <ol style="list-style-type: none"> 1, Not in the prescribed form. 2. Not accompanied by the required EMD (or) permanent EMD (or) proof for exemption. 3. Not properly signed by the tenderer. 4. from any black listed firm or contractor. 5. received after the expiry of the due date and time. 6. Received by telex or telegram. 7. Not accompanied by an undertaking/agreement where EMD or Security Deposit is to 	

	<p>be exempted.</p> <p>.8. Not in any conformity with the Board's Technical Specifications.</p> <p>9. from any approved tenderer whose permanent EMD is inadequate for the particular tender.</p>
(iii)	<p><u>State Transmission Utility's function</u> / Distribution code. Page no: 188 / mark:5.</p> <p>The functions are to,</p> <ol style="list-style-type: none"> 1.Undertake transmission of energy through intra state transmission system. 2.Discharge all function of planning and coordination of ISTS taking in to account the national power plans and guide lines issued by Central Electricity Authority [CEA] in coordination with all the concerned organizations. 3.Ensure development of an efficient coordinated economical system of intra state transmission lines for smooth flow of electricity from the generating source to load centers. 4. Provide non-discriminatory open access to its transmission systems for use by, (i) any licensee or generating company on payment of the transmission charges, (or) (ii) any consumer as an when such open access is introduced by the commission under sub-section (2) of section (42) of the act on payment of the transmission charges and a surcharge there on, as may be specified by the commission. 5.Implement the code with respect to the Distribution licensees and over see for prudent practices and grid discipline. 6. Facilitate review and recommend amendments to the code to commission with out prejudice to the provisions in clause 51 of this code. 7. Recommend for issue of distribution licenses. 8.Superivse, direct and control the works of construction, operation, maintenance of any ISTS . 9. Take measures for resolution of issues arising due to non compliance of operational / commercial provisions of the code by the respectable entities.
(iv)	<p>Mandatory contents in tender document /Tender regulation 1991/Page: 13 & 14.</p> <ol style="list-style-type: none"> 1.The standard specification setting out the technical requirements and commercial terms. 2. In the absence of standard specification, a complete specification of the work to be executed, the material to be used (or) the supply of materials. to be made. 3. A schedule of quantities of variable items of work to be executed or supply of materials to be made. 4. A complete set of drawings showing the general dimension of the proposed work or materials and 5. A set of condition of the contract.
4.(i)	<p>(a) COGENERATION / Grid Code Page: 2. [mark: 2 + 2]</p> <p>The Cogeneration means a process , which simultaneously produces two or more forms of useful energy including electricity.</p> <p>(b) SPINNING RESERVE/ Grid Code: Page: 6</p> <p>Part loaded generating capacity with some reserve margin that is synchronized to the system and is ready to provide increased generation at short notice pursuant to dispatch instruction or instantaneously on response to a frequency drop.</p>

(ii)	<p>Safety precautions to be observed while erecting the distribution transformers. Safety manual. Page no:49. [mark:4]</p> <ol style="list-style-type: none"> 1. The distribution transformer structure should be erected with special poles designed to withstand the weight of the transformer. 2. The poles should not have any deflection and it should be straight. 3. The poles should be tied with stay arrangement with guy insulator. 4. No persons allowed to stand or sit beneath the transformer while lifting. 5. The distribution structure should not erected in leaned poles or street light poles. 6. The appropriate chain block should be used for loading/unloading. 7. The side channels should be bolted
(iii)	<p>The records exempted from destruction. /TNEB volume Administrative, Financial & account procedure. Page: 51. [mark:4]</p> <ol style="list-style-type: none"> 1. The records in connection with expenditure which is within the statute of limitation. 2. Records in connection with expenditure on works not completed although beyond the period of limitation. 3. Records of experiments and observation. 4. Records in connection with claims to service and personal matters connected with persons in the service.
(iv)	<p>Distribution code.P.208 [mark:4].</p> <p>If an intending consumer fails to avail supply within the notice period , further three months notice in case of HT & one month notice for LT has to be sent to the intending consumer. If the supply still not availed with in the further notice period, the application will be treated cancelled in case of LT applicant and in case of HT applicant Agreement will be terminated.</p> <p>In case of HT applicant the service connection, security deposit, development charges except the meter caution deposit will be forfeited.</p> <p>In case of the intending consumer could not avail the supply under force majeure conditions then all charges paid will be refunded.</p>
(v)	<p>Procedure for process of evaluation of tender report and award of tender? Tender rules 2000 / mark:4. [Page: 18]</p> <ol style="list-style-type: none"> 1. Subject to the provision of sections 12 and 13 of the Act, the Tender inviting authority shall insure the confidentiality of the process of tender evaluation until orders of the tenders are passed. 2. The tender accepting authority shall cause the information on orders passed on the tenders published in the tender bulletin. 3. Tenderers shall not make attempts to establish unsolicited and unauthorized contact With the tender accepting authority , tender inviting authority, or tender scrutiny committee after the opening of the committee after the opening of the tender and prior to the notification of the award and any attempt by a tenderer to bring to bear extraneous pressures on the tender accepting authority shall be sufficient reason to disqualify the tenderer.

	4. Not with standing any thing contained in sub rule (3), the tender inviting authority or the tender accepting authority may seek bonafide clarifications from the tenderers relating to the tenders submitted by them during the evaluation of tenders.
5. (i)	<p>Scope of availability based tariff [ABT] and automatic frequency based load shedding. (mark:4)</p> <p>Grid code . Page: 45.</p> <p>All entities shall put in all possible efforts to ensure that the grid is operated within the frequency limits prescribed by the implementation of Availability Based Tariff [ABT] i.e frequency always remains within the 49.0 – 50.5 Hz band.</p> <p>The state entities shall provide automatic under frequency load shedding, based on the operation of df/dt or constant frequency setting relay in their respective systems, to arrest frequency decline that could result in a collapse/disintegration of the grid as per the plan separately finalized by SLDC in consultation with STU, and shall ensure its effective application to prevent cascaded tripping of generating units in case of any contingency. All entities shall ensure that the under frequency load shedding / islanding Schemes are functional and no under frequency relay is bypassed or removed without prior consent of SLDC.</p>
(ii)	<p>Structure of TN Electricity Grid code [Grid code Page:9] (mark:4)</p> <p>The code is structured in distinct chapters as follows.</p> <ol style="list-style-type: none"> 1. Functional responsibilities of entities connected with state grid. 2. System planning. 3. Grid connectivity conditions. 4. Requirement of grid operation. 5. Scheduling and dispatch. 6. Commercial issues and implementation. 7. Non compliance.
(iii)	<p>Contingencies [works]. TNEB Vol.1 Page: 4 [mark:2+2]</p> <p>When used in respect of accounts of works, the term CONTINGENCIES indicates incidental expenses of a miscellaneous character which can not appropriately be classified under any distinct sub head or sub work, yet pertain to the work as a whole.</p> <p>LICENSEE [PAGE:7] Licensee means any person or body licensed under part II of the Indian Electricity Act to supply electrical energy.</p>
(iv)	<p>Role of Ombudsman appointed by the state electricity commission.</p> <p>Electricity Act 2003. Page: 25 (mark:4)</p> <p>Every distribution licensee shall within 6 months from the appointed date or date of grant of licensee , which ever is earlier establish a forum for redressal of grievances of the consumers in accordance with guidelines as may be specified by the state commission.</p> <p>Any consumer who is aggrieved by non-redressal of his grievances under sub section (v) may make a representation for the redressal of grievances to an authority to be known as ‘Ombudsman’ to be appointed or designated by the state commission.</p> <p>Any Ombudsman shall settle the grievance of the consumer within such manner as may be specified by the state commission. The provision of sub sections (5) (6) and (7)</p>

	shall be without prejudice to right which the consumer may have apart from the rights conferred upon him by those sub sections.
(v)	<p>Paralleling power transformers of vector group DY11 to DY1 (mark:4) Ref: Code of Technical Instructions –Page: 83 While paralleling DY 11 vector group transformer with DY1 group unit arises, jumpering connection for any two phases on HV side and for corresponding two phases of LV side for DY1 group transformer may be interchanged. If there is any mechanical constraint in making change of connection to DY1 group unit, the same may be carried out for the DY11 unit. However as majority of the units in service are DY11 group change of connections to DY1 group unit may be preferred for the sake of uniformity.</p>
6 (i)	<p>Terms and condition admissible for deviation even after the acceptance of tender Tender Regulation 1991 . Page : 29,30 (mark:5)</p> <ol style="list-style-type: none"> 1. Mode of dispatch. 2. Allocation of quantity among circles. 3. Waiver of inspection of materials. 4. Waiver of test certificates. 5. Waiver of income tax and sales tax clearance certificate. 6. Acceptance of excess or short supply within 5% of the ordered quantity (without levy of liquidated damages for short supply) for good and sufficient reasons. 7. Acceptance of increase in the value of purchase order/contract caused by supplemental items/additions/deletions/alterations to the component items included in the scope of supply / contract provided that the increase in value is within the monetary power of CE/competent authority under single tender. 8. Condonation of delay irrespective of the period involved if the total liquidated damages involved less than Rs 1000/- 9. Change of parameters indicated in the original offer necessitated during detailed Engineering such as motor rating, pump head, capacity etc can be approved by CE where any commercial implications are not involved. 10. Waiver of undertaking in lieu of security deposit and performance guarantee in respect of public sector undertakings can be approved by the CE.
(ii)	<p>Maintenance of specific gravity of the station battery: (mark:5) Code of Technical instruction/ Page: 20 After the addition of little quantum distilled water, there will be wide difference of specific gravity. As the specific gravity of water is lower than acid in the cell, if distilled water is poured very slowly, there will be a tendency for a water to lie on the surface. It will be advisable to introduce distilled water in to bottom of the cell by means of glass tube or rubber syringe well below the level of acid near the bottom of the cell. Distilled water is best added when the specific gravity of the acid in the cell is in the lower limit. i.e just before commencing charge. While introducing the distilled water, care should be taken not to disturb the deposits at the bottom of the cell. Only distilled water is added to the cells. Acid should not be added to the battery. If Specific gravity of the cell comes too far down, can not be improved by cycle of charge and discharge in addition of acid may be inevitable and take as per the manufacturer's</p>

	advice.
(iii)	<p>Procedures to be adopted in case of electrical accident /Electricity act 2003/page.71 {Also in Distribution code.Page:198.} (mark:5)</p> <p>If any accident occurs in connection with generation, transmission or distribution, supply or use in electricity in or in connection with any part of the electric lines or electrical plant of any person and the accident results or is likely to have resulted in loss of human or animal life or in any injury to a human being or an animal , such in person shall give notice of the occurrence and of any such loss or injury actually caused by the accident, in such form and with in such time as may be prescribed, to the electrical inspector or such other person as aforesaid and to such authorities as the appropriate government may by general or special order , direct.</p> <p>2. The appropriate Govt may if it thinks fit, require any electrical inspector, or any other person appointed by it in this behalf, to enquire and report.</p> <p>(i). As to the cause any accident affecting the safety of the public,which may have been occasioned by or in connection with , the generation, transmission, distribution, supply or use of electricity, or</p> <p>(ii) As to the manner in, and extent to which the provision of the act or rules and regulations made there under or any license, so far as those provisions affect the safety Of any person, have been complied with.</p> <p>3. Every electrical inspector or other person holding an enquiry under sub section (2) shall have all the powers of the civil court under the code of civil procedure, 1908 for the purpose of enforcing the attendance of witnesses and compelling the production of documents and material objects and every person required by an electrical inspector be legally bound to do so within the meaning of section 176 of IPC.</p>
(iv)	<p>The key issues in respect of generator planning (mark: 5) Grid code. Page no:20 , 21.</p> <ol style="list-style-type: none"> 1. Predicting the establishment of new generation capacity, including where, when, and how much.\ 2. Predicting generation dispatch. 3. Provision towards generation reserve for reliability of supply. 4. Predicting decommissioning of old generation capacity. 5. Environmental regulation leading to an increasing amount of renewable energy sources generation with prioritized grid access. 6. The impact of wind generators, Co-generators, and captive generation units on the dynamic performance of the power system considering its special nature. 7. Impact large generating plant on the grid. 8. Increasing amount of non-despatchable generation. 9. Marginal costs of generators. 10. Price elasticity of consumers. 11. Market players estimates of future power prices. 12. Rules for access too the capacity on the interconnection.
7. (i)	<p><u>The costs to be borne by the intending consumer to shift his service connection.</u> Distn code: Page: 210 . (mark:4)</p>

Contd.

	<ol style="list-style-type: none"> 1. Charges for dismantling of materials at old site. 2. Charges for transport from the old site to the new site. 3. Charges for re-erection at new site. 4. Depreciated value of retrievable materials, if any not used at the site should be given credit. 5. Cost of new materials including transport if required. 6. Cost of irretrievable materials at depreciated value. 7. Over head charges. 8. Arrears if any payable in his service connection account.
(ii)	<p>Procedure for assessment in service connection without meter or defective meter TNEB manual : Page: 170. 171. (mark:4)</p> <p>If a service is without meter for few days only in a month, the consumption for the period should be calculated on the basis of the average consumption of the past three available months and not on the basis of average consumption per day during that month.</p> <p>In case of first unmetered connection, the average consumption, for the metered period will be taken for the unmetered period also.</p> <p>In the case of LT services where the past three months consumption is not available and where the meter get struck up after one or two months initial supply, the consumption may be arrived basis of past consumption.</p>
(iii)	<p>Polarization index and minimum insulation resistance formula. (mark:4) Technical code of instruction. P: 282, 283</p> <p>Polarization index is the ratio of insulation resistance value measured at the end of 10 minutes and insulation resistance value at one minute preferably using motorized megger.</p> $P.I = \frac{IR \text{ at the end of 10 minutes}}{IR \text{ at the end of 1 minute.}}$ <p>Minimum insulation resistance : This is a guide to maintenance personnel regarding the safe IR value.</p> $\text{Minimum IR value} = \frac{\text{Rated voltage}}{1000} \text{ mega ohms.}$
(iv)	<p>Basic rules on absorption and generation of reactive power [VAR] Grid code: Page 61. (mark:4)</p> <p>The basic rules for absorption / generation are,</p> <ol style="list-style-type: none"> 1. The beneficiary pays for VAR drawl when voltage at the metering point is below 97%. 2. The beneficiary gets paid for VAR return when the voltage is below 97% 3. The beneficiary gets paid for VAR drawl when voltage is above 103% 4. The beneficiary pays for VAR return when voltage is above 103%.
(v)	<p>The safety precautions to be followed while transporting electric poles. Safety manual Page: 67,68. (mark:4)</p> <ol style="list-style-type: none"> 1. The electric poles should be firmly tied with the vehicle.

Can't
Can't.

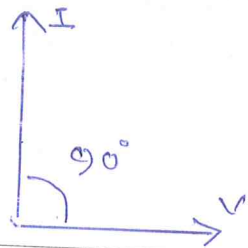
<p>1(v)</p>	<ol style="list-style-type: none"> 2. The vehicle speed should be controllable limited speed. 3. The red flag should be tied at the tip of the poles back side. 4. A Red lamp should be kept and kept burning condition at night and an be viewed in all direction. 5. Strong manila rope and sling should be used.
<p>8. (i)</p>	<p>Forecast methodology adopted in distribution system planning / (mark: 10) Distribution code: Page: 192. The licensee shall formulate the long term demand forecast taking in to account the previous financial year ending March 31st as the base year and projecting the demand over the succeeding five years.</p> <ol style="list-style-type: none"> 1. Energy sales per tariff class shall be projected in the forecast period over the corresponding figures relating to the base year by adopting a suitable methodology, such as considering the trend for the previous five years. 2. The projection shall in to account assumed normal growth for non specific loads, specific and identified loads of 1 MW and above and also the effects if any, of demand side management and loss reduction measures. 3. The licensee shall compare the aggregate energy requirement at each of the correction point with the transmission system after accounting for system losses. The future peak load in each of the years in the fore cast period may be derived using an annual load factor. 4. The licensee shall take in to consideration any authorized report on demand forecast or power survey carried out by agencies like Advisory Board on energy, planning commission, Central Electricity Authority, STU commission, CERC and Govt of Tamil Nadu.
<p>(ii)</p>	<p>Power factor and dissipation factor of a condenser type bushing. (mark .10) Technical code of instruction. Page: 123 & 124. (Theory: 6mark + Vector sketch: 2 mark + Connection diagram: 2 mark)</p> <p>If a steady voltage V is applied to the plates of perfect capacitor a charging current flows from the supply for a short time and gives to the capacitor, a certain quantity Q of electricity which is sufficient to produce potential difference between the capacitor plates of V volts. When this potential difference has been attained the current ceases to flow, the quantity of electricity Q which has been supplied being given by $Q=CV$ where C is the capacitance and is of course dependent upon the permittivity of the dielectric. In a perfect capacitor, therefore the dielectric has only the electrical property viz. that of permittivity. In all practical dielectrics, the current does not cease after a short time but dies away gradually over a long period of time.</p> <p>A small conduction current will flow through the dielectric because of the resistance of the dielectric though very high. If a sinusoidal voltage is applied to a perfect capacitor the current which flows in to the capacitor leads the voltage in phase by 90°. Owing to the dielectric loss the current in the capacitors used in practice leads the voltage by an angle slightly less than 90° [fig.2]. The angle ϕ is the phase angle . The angle δ which is equal to $90-\phi$ is called loss angle. The power factor is equal to Cosine of the angle ϕ or sine of angle δ. The dielectric dissipation factor is equal to $\tan \delta$ when ϕ is nearing 90°.</p> <p>The power factor is the reliable indicator of deterioration of the dielectric in a bushing.</p>

The power factor of sealed bushing is low initially and remains low in service if the bushing is in good condition. An increase in power factor is evidence of a change in the characteristics of the dielectric and a continuing trend towards high power factor shows potentially damaging condition is developing. Persistently stable power reading offer assurance that the internal parts of the bushing are in good condition.

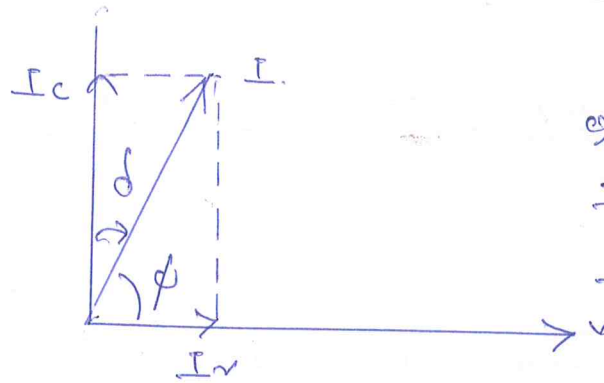
POWER FACTOR TAP: The condenser bushings are provided with power factor tap for conducting $\tan \delta$ tests. The arrangement is shown in [fig 3].

The maximum values of $\tan \delta$ measured at U_n for $U_n < 52$ KV at $0.3 U_n$ for $U_n > 52$ KV are as follows as per IS 2099 / 1986.

CONDENSER BUSHINGS	
	TYPICAL TAN δ VALUE
Resin impregnated paper Resin-bonded paper cast insulation composite.	0.015
Oil impregnated paper	0.007



8 (ii)



$90 - \phi = \text{Loss Angle}$
 $I_r = \text{Resistive Current Component}$
 $I_c = \text{Capacitive Current Component}$

