

# ODISHA PUBLIC SERVICE COMMISSION

ADVERTISEMENT NO. 02 OF 2012-13

**Recruitment of Assistant Engineer (Electrical) in Class-II (Group-B) of Odisha Engineering Service under Department of Energy.**

WEBSITE – <http://opsconline.gov.in>

**WARNING : (1) ONLINE APPLICATION FORM WILL BE AVAILABLE TILL 04.09.2012 11:59 P.M**

**(2) LAST DATE FOR RECEIPT OF APPLICATION FEE AT ANY SBI BRANCH IS 06.09.2012.**

**(3) LAST DATE FOR RECEIPT OF PRINT OUT/HARD COPY OF ONLINE APPLICATION ALONGWITH COPY OF SPECIFIED DOUEMNTS/ CERTIFICATES IS 17.09.2012 BY 5.00 P.M.**

Applications are invited On-line through the proforma Application to be made available on WEBSITE (<http://opsconline.gov.in>) from 04.08.2012 to 04.09.2012 (**Note: 06.09.2012 is the last date for payment of application fees**) for recruitment to 38(thirty eight) posts of Assistant Engineer (Electrical) in Class-II (Group-B) of Odisha Engineering Service under Department of Energy in the scale of pay of Rs.9300-34800/- carrying Grade Pay of Rs.4600/- with usual Dearness and other Allowances as may be sanctioned by the Government of Odisha from time to time.

**2. VACANCY POSITION : As per requisition filed by the Department of Energy, the vacancy position along with reservation thereof is given below:**

	<u>Category</u>	<u>No. of Posts</u>
(i)	U.R.	09 (03 -Women)
(ii)	Scheduled Caste	03 (01 -Women)
(iii)	Scheduled Tribe	11 (04 -Women)
(iv)	S.E.B.C.	<u>15 (05 -Women)</u>
		Total – 38 (13 -Women)

(a) Out of the vacancies mentioned above, 01 (one)post is reserved for Ex-Serviceman,01(one) post is reserved for Sports person and 01 (one) post is reserved for Physical Handicapped(partially deaf with suitable aid).

The candidates belonging to P.H/Ex-Servicemen./Sports person when selected as per reservation provided for them, shall be adjusted against the categories to which they belong.

(b) In case of non-availability of eligible/suitable Women candidate(s) belonging to the respective category, the unfilled vacancies of that category shall be filled up by eligible/suitable Male candidate(s) of the same category.

(c) The Exchange of reservation between SC & S.T. will not be considered.

**3. EDUCATIONAL QUALIFICATION :**

A candidate must (a) hold a Degree in Electrical Engineering from an Indian University; or (b) be an Associated Member of the Institution of Engineers Electrical (India), or (c) hold a degree as enumerated in the Appendix-I of this advertisement.

**4. AGE :** (i) A candidate must be under 32 (thirty two) years and above 21 (twenty one) years of age on the 1<sup>st</sup> August, 2011 i.e. he/she must have been born not earlier than 2<sup>nd</sup> August, 1979, and not later than 1<sup>st</sup> August, 1990.

The upper age limit is relaxable by 5 (five) years for candidates belonging to the categories of Scheduled Castes(S.C.), Scheduled Tribes(S.T.), Socially & Educationally Backward Classes (S.E.B.C.), Women, Ex-servicemen, and by 10 (ten) years for Physically Handicapped candidates.

Further, the upper age limit is fully relaxed in favour of Junior Engineers who have subsequently acquired prescribed qualification as provided under Para-3 of the Advt., by the closing date of receipt of application.

Provided that in case a candidate who comes under more than one category mentioned above, he/she will be eligible for only one age relaxation benefit, which shall be considered most beneficial to him/her.

**SAVE AS PROVIDED ABOVE, THE AGE LIMITS PRESCRIBED CAN IN NO CASE BE RELAXED.**

Date of birth entered in the High School Certificate or equivalent Certificate issued by the concerned Board/Council will only be accepted by the Commission.

**5. APPLICATION FEE -**

A candidate is required to pay a non-refundable and non-adjustable fee of Rs.300/-(Rupees three hundred) only. **Candidates belonging to Scheduled Caste/Scheduled Tribe of Odisha only are exempted from payment of this fee.**

**The candidates are required to take a printout of the finally submitted Online Application Form for future use and take a printout of Online Challan (Pay-in-Slip) for payment of requisite fee at any branch of State Bank of India (SBI). The Fee(s) paid shall not be refunded under any circumstances nor can the fee(s) be adjusted or held in reserve for any other examination or recruitment.**

**6. METHOD OF SELECTION :** (a)The selection of candidates for recruitment to the post shall be made on the basis of career assessment, written examination and Viva Voce Test.

(b) The Commission will short-list the candidates to be called for viva voce test to a reasonable number taking into consideration the marks secured in the written examination above the cutoff point to be fixed by the Commission together with the evaluation of their academic career.

The broad outlines of the syllabi for the said examination are enclosed (Appendix-II).

## 7. PLACE OF EXAMINATION :

The written examination will be held at Cuttack. It may also be held at Bhubaneswar/ Balasore/Berhampur/Sambalpur depending on the number of candidates from the respective zone.

The candidates are to mention their choice of Examination Zone at appropriate place in the online application form.

## 8. OTHER ELIGIBILITY CONDITIONS :

- (a) (i) The candidate must be a citizen of India;
- (ii) The candidate must be of (a) good moral character, and (b) sound health, good physique and active habits and free from organic defects or bodily infirmity (except the Physically Handicapped);
- (iii) The candidate must be able to speak, read and write Odia fluently and must have passed: at least an examination in Odia language equivalent to that of Middle English School standard conducted by the **Board of Secondary Education, Odisha; or the Education Department of Government of Odisha or any other Board or Council of Secondary Education approved by the Government of Odisha** in support of passing of Odia Language Test (M.E. School standard);
- (iv) A candidate, who has more than one spouse living, will not be eligible for appointment unless the State Government has exempted his/her case from operation of this limitation for any good and sufficient reasons;
- (v) Government servants, whether temporary or permanent, are eligible to apply provided that they possess the requisite qualification and are within the prescribed age-limit as provided under Para-3 & 4 of the Advertisement. They must inform their respective Heads of Offices in writing regarding submission of their applications for this recruitment and obtain "No Objection Certificate";
- (vi) If a candidate has at any time, been debarred for a certain period/chance(s) by the Odisha Public Service Commission or other State Public Service Commission or U.P.S.C. from appearing at any examination/interview, he/she will not be eligible for such recruitment for that specified period/chance(s);
- (vii) **Only those candidates, who fulfil the requisite qualification & within the prescribed age limit etc. by the closing date of receipt of application, will be considered eligible;**
- (b) Every candidate selected for appointment shall be examined by the Medical Board. A candidate, who fails to satisfy the Medical Board, shall not be appointed;

9. **OTHER CONDITIONS :**

(i) A candidate found guilty of seeking support for his/her candidature by offering illegal gratification or applying pressure on any person connected with the conduct of the recruitment process or found indulging in any type of malpractice in course of the selection or otherwise, shall, in addition to rendering himself/herself liable to criminal prosecution, be disqualified not only for the recruitment for which he/she is a candidate, but also may be debarred, either permanently or for a specified period, from any recruitment or selection to be conducted by the Commission;

(ii) The provisions of the Odisha Conduct of Examination Act 1988 (Odisha Act-2 of 1988) are applicable to the examination conducted by the Odisha Public Service Commission.

(iii) **Online applications submitted to OPSC if found to be incomplete in any respect are liable to rejection without entertaining any correspondence with the applicants on that score;**

(iv) Admission to Examination/viva voce will be provisional. If on verification at any stage before or after the examination/viva voce, it is found that a candidate does not fulfil all the eligibility conditions, his/her candidature will be liable to rejection. Decision of the Commission in regard to eligibility or otherwise of candidate shall be final.

(v) This advertisement should not be construed as binding on the Government to make appointment;

(vi) Every Assistant Engineer on his/her first appointment to the service shall be on probation for a period of two years from the date he/she actually joins in the post. The appointment can be terminated on one months notice from either side without assigning any reason thereof.

(vii) Concessions meant for S.C., S.T. & SEBC by Birth are admissible to the Scheduled Caste, Scheduled Tribe and Socially & Educationally Backward Classes of Odisha only;

(viii) Candidates are required to take due care to annex with the printout/hard copy of online applications, the copies of certificates and other documents as stated under Para-11 of this advertisement.

(ix) No one will be admitted to the examination unless he/she holds a certificate of admission uploaded in the website of OPSC. The eligible candidate may download their admission certificate from the website of Commission and produce the same before the Centre Supervisor for admission to the Examination Centre;

(x) All persons appointed under the Government of Odisha on or after 1<sup>st</sup> January, 2005 shall not be eligible for pension as defined under sub-rule(1) of Rule-3 of the Odisha Civil Service (Pension) Rules, 1992; but shall be covered by the defined Contribution Pension Scheme in accordance with the Odisha Civil Service (Pension) Amendment Rules, 2005;

(xi) Any misrepresentation or suppression of information by the candidate in the online application, will result in cancellation of this candidature or penalty, as decided by the Commission be imposed on the candidate.

(xii) Mere empanelment in the select list shall not confer any right for appointment unless the Government is satisfied after making such enquiry as may be deemed necessary that the candidate is suitable in all respects for appointment to the service.

#### 10. MAIN JOB CHART :

- (i) The officer is responsible to Divisional Officer in all matters concerned with the efficient management and execution of work within his jurisdiction.
- (ii) Timely and careful field survey and investigation, preparation of plans and estimates. Any mistake should be brought to the notice of the Divisional Officer.
- (iii) Prompt and efficient execution of work according to the terms.
- (iv) Regular inspection of work to ensure their execution.
- (v) To ensure that the Sub-ordinate staff are performing their duties properly.
- (vi) The Officer must satisfy himself that the work has actually been executed in accordance with the detailed measurements recorded.
- (vii) The Officer is responsible to see that proper accounts of stores and tools and plants are maintained in accordance with the prescribed rules and procedure.
- (viii) The Officer is responsible for the correct assessment and prompt recovery of all Government revenue and other dues under his jurisdiction.
- (ix) The Officer must report immediately any unusual, extra-ordinary or peculiar occurrence, which takes place within his jurisdiction to his Divisional Officer and to any other authorities as may be necessary.

**The duties indicated above are illustrative and not exhaustive.**

11. **CERTIFICATES/DOCUMENTS TO BE ATTACHED :** Candidates are required to submit along with the printout/hard copy of online applications, true copies of the following documents duly attested by candidate or Gazetted Officer or Notary Public. The candidates are also required to mention on each document “submitted by me” and put their full signature on the same. **They must not attach original certificates to their applications.** Only those, who are called for the viva voce test will be required to bring with them the original certificates, mark-sheets etc. of the attested copies for verification at the time of viva voce test.

If a candidate fails to furnish any of the original documents in respect of the attested copies submitted with the application for verification on the date of interview before the interview starts, he/she shall not be allowed to appear at the interview.

- (i) H.S.C. or equivalent certificate in support of declaration of age issued by the concerned Board/Council;
- (ii) P.U./P.P./Intermediate/+2 Examination Certificate issued by the concerned Board/Council;
- (iii) Degree in Engineering (Electrical) Certificate from recognised University issued by the University;
- (iv) Mark-lists of all semesters/Annual Examinations in support of Degree in Engineering(Electrical) passed including fail marks, if any;

**NOTE** - (a) Candidates who have not been awarded percentage of marks, but only “GRADE MARKS”, should, along with their applications, produce the conversion certificate from the concerned University indicating the actual equivalent percentage of marks and the conversion formula failing which, their applications are liable to be rejected.

- (b) While filling up the relevant box of the online application form, the candidate has to mention details of marks secured in each Semester/Annual examination leading to award of Degree.
- (v) (a) Attach two recent passport size photographs(unsigned & unattested) which has been uploaded with online application in printout/hard copy of online application form.
- (b) Certificates of conduct from the Principal/Proctor/Dean or Professor in charge of a Department of Teaching of the College or University in which he/she last studied; and
- (vi) Caste Certificate by birth in support of claim as S.Cs./S.Ts./S.E.B.Cs., wherever applicable (Please see Note-1);
- (vii) Required odia pass certificate from the Board of Secondary Education, Odisha indicating Odia as a language subject equivalent to M.E. School Standard or a certificate from the Principal/Headmaster of the School indicating that the candidate has passed Odia in M.E. Standard;
- (x) Discharge Certificates issued by the Commanding Officer of the Unit last served wherever applicable;
- (xi) Identity Card issued by the Director of Sports, Odisha, wherever applicable;
- (xii) Disability Certificate (indicating percentage of disability) issued by the concerned Medical Board, wherever applicable;

- (xiii) If a candidate claims to possess qualification, equivalent to the prescribed qualification, the rule/authority (With number and date) under which it is so treated, must be furnished with the printout/hard copy of the online Application Form.

**NOTE 1** : Candidates claiming to be belonging to S.C./S.T./S.E.B.C. category by birth are required to submit copy of the relevant Caste Certificate issued by the competent authority in the prescribed form. Candidates of SEBC category (other than Creamy Layer) must submit copy of Caste Certificate issued by the competent authority within the last three years from the date of advertisement by the competent authority in the prescribed form.

- (i) Women candidates belonging to S.C./S.T./S.E.B.C. are required to submit Caste Certificates by birth showing “daughter of .....” Caste Certificates by virtue of marriage (i.e. showing “wife of .....”) are not acceptable.
- (ii) OBC CERTIFICATES **WILL NOT BE ACCEPTED** IN LIEU OF S.E.B.C. CERTIFICATES.
- (iii) Community (Caste status) once mentioned by the candidates shall not be changed under any circumstances.

The competent authorities are: - District Magistrate/Collector or Additional District Magistrate or Sub-divisional Magistrate/Sub-Collectors or Executive Magistrates or Revenue Officers, not below the rank of Tahasildar /Additional Tahasildar of Government of Odisha;

**NOTE 2** : Degree Certificate, Caste Certificate, Odia Test Pass Certificate, Discharge Certificate of Ex-servicemen, Identity Card of Sportspersons and Identity Card of Physically Handicapped Persons must have been issued by the competent authority within the last date fixed for receipt of applications as indicated above.

## 12. HOW TO APPLY:

- a. Candidate must go through this Advertisement available in the Website of OPSC before filling up online application.
- b. Candidates must apply online through the website <http://opsconline.gov.in>. Applications received through any other mode would not be accepted and summarily rejected.
- c. Before filling up the online application form, the candidates must go through the following documents available at OPSC portal.
  - i [Instruction to fill up online application.](#)
  - ii [Guideline for scanning and Upload of Photograph, Full Signature & Left Hand Thumb Impression.](#)

- d. Candidates are requested to upload the scanned image of latest passport size photograph along with scanned image of his/her full signature and scanned image of Left hand Thumb Impression(LTI) in the online application form. Uploaded photograph, specimen (full) signature and LTI must be clearly identifiable / visible, otherwise the application of the candidate is liable to be rejected by the Commission and no representation from the candidate will be entertained.
- e. Candidates should keep at least 2 copies of latest passport size photograph which is uploaded to the online application form for future use.
- f. The candidates are required to take a printout of the finally submitted Online Application Form for future use and take a printout of Online Challan (Pay-in-Slip) for payment of requisite fee at any branch of State Bank of India (SBI). The Fee(s) paid shall not be refunded under any circumstances nor can the fee(s) be adjusted or held in reserve for any other examination or recruitment.
- g. On successful submission of application form, an Unique Registration ID will be displayed on the screen as well as top of the application form. Candidates are requested to note down the Unique Registration ID and use it in future correspondence.
- h. Candidates are required to send the Printout/Hard copy of the Online Application Form along with specified documents/ certificates etc. as provided under para-11 of this advertisement along with OPSC copy of Challan showing payment of examination fee, by Registered Post/Speed Post/Courier Service to the Special Secretary, Odisha Public Service Commission, 19, Dr. P.K. Parija Road, Cuttack-753001so as to reach the same in OPSC on or before 17.09.2012. The SC/ST candidates are not required to enclose the copy of challan showing payment of fee.**

**The envelope containing the application must be superscribed "APPLICATION FOR THE POST OF ASSISTANT ENGINEER (ELECTRICAL)". Application received after the closing date shall not be entertained. The Commission will not take any responsibility if the application is not received in time. The candidate may also submit the copy of the Printout/Hard copy of the Online Application Form along with specified documents/ certificates etc. as provided under para-11 of this advertisement along with OPSC copy of Challan showing payment of examination fee in the office of the Odisha Public Service Commission directly/personally on or before the last date of receipt of applications at the counter.**

- i. The candidates are advised to submit the Online Application Form well in advance without waiting for the closing date to avoid last hour rush.**
- j. Certificate of Admission to the Examination or Interview to the eligible candidates will be uploaded in the Website of OPSC prior to the date of examination or interview which will be published in the Website and News paper. The candidates are required to download their Admission Certificate from Website. No separate correspondence will be made on this score.

(9)

**13. FACILITATION COUNTER:**

During filling up the online application form the candidate may contact facilitation counter of OCAC over toll free Telephone No. **18003456770 OR 155335** for any technical guidance.

In case of any guidance/information on advertisement & recruitment, candidates may contact the O.P.S.C. Facilitation Counter over Telephone No.0671-2304141/2305611 & Extn.-218 or 223 in any working day between 10.30 A.M. to 1.30 P.M. & 2.00 P.M. to 5.00 P.M.

The candidates are required to visit the Website of the Commission at <http://opsconline.gov.in> OR <http://opsc.nic.in> for detailed information about the programme of the examination(s) etc. and also keep track of publication of various notices to the effect in the leading local daily newspapers for information.

CUTTACK

DATE :02.08.2012

SPECIAL SECRETARY,  
ODISHA PUBLIC SERVICE COMMISSION,  
CUTTACK.

## APPENDIX – I

List of Engineering Degrees from Universities of the United Kingdom and examinations, which will be accepted by the Government of Odisha as qualifying for appointment to the Odisha Service of Engineers.

### **Engineering Degrees –**

Oxford	-	B.A. with Honours in the Engineering science Final Honours School.
St. Andrews	-	B.Sc. in Engineering
Glasgow	-	B.Sc. in Engineering
Edinburgh	-	B.Sc. in Engineering
Dublin	-	B.A.I. (Ordinary or with Honours in Engineering)
Birmingham	-	B.Sc. in Electrical Engineering (Honours or ordinary Degree)
Liverpool	-	B. Engineering in Electrical (Honours or ordinary Degree)
Leeds	-	B.Sc. in Electrical Engineering (Honours or ordinary Degree)
Sheffield	-	B. Engineering in Electrical Engineering (Honours degree or Ordinary degree with a first Class in the final Examination)
Bristol	-	B.Sc. in Electrical Engineering.(Honours or ordinary Degree)
Victoria University (Manchester)	-	B.Sc. with Honours in Electrical Engineering, (Honours Division in the final examination).
University of Wales	-	B.Sc. in Electrical Engineering.
National University of Ireland	-	B.E.
Queer's University Belfast	-	B.Sc. in Electrical Engineering.

**Note :-** The above degrees will be accepted only if taken after three years' study and the passing of the regular examination in the several University. The Rule requiring three years' study will not, however, apply to Indians, who having taken an Indian degree, which exempts them from part of the University course, have taken one of the above degrees in less than three years in accordance with the regulations of the University concerned.

2. A pass in Section A and B at the Associate Membership Examination of the Institution of Engineers (India).

**Appendix-II**  
**Plan of Examination**

1. The written examination will consist of two papers with 600 marks. Paper-I General Ability Test .

Sl. No.	General Ability Test	Pattern	No. of questions	Total marks	Duration
(i)	Basic Engineering Aptitude	Objective type/ Multiple choice	50	100	2.30 hrs.
(ii)	General English	Ditto	50	100	
(iii)	General Studies	Ditto	50	100	
		Total	150	300	

Paper-II Electrical Engineering – (Part ‘A’ & ‘B’)

Subject	Pattern	No. of questions	Total marks	Duration for both the parts together
Electrical Engineering Part A	ObjectiveType/ Multiple Choice	75	150	2.30 hrs.
Electrical Engineering Part B	Ditto	75	150	
		Total	150	300

Schedule to Appendix-II  
Standard and syllabi

2. The standard of papers in the Engineering subjects will be that of Engineering Degree Examination.

3. There will be negative marking for wrong answers.

4. (i) All question papers will be set in English and the same should be answered in English only.
- (ii) The candidates are not allowed to bring calculators or any other electronic devices to the examination hall/examination campus for use.
- (iii) Mobile phones, pagers or any other communication devices are not allowed inside the premises of the Examination Centre and Office of the Commission.

Any infringement of these instructions shall entail disciplinary action including ban from future examination.

## **Broad outline of Paper-I General Ability Test**

(i) **Basic Engineering Aptitude (Broad Outline)**

1. Basic Electrical Engineering.
2. Basic Civil Engineering (Building Material)
3. General Drg., Building Drg. & M/C Drg.
4. Basic Electronics.
5. Applied thermodynamics.
6. Principles of Management.
7. Introduction to strength of Material/Mechanics of material.
8. Engineering Mechanics (Static & dynamics)
9. Computer Fundamentals.

(ii) **General English**. The question paper in General English will be designed to test the candidate's understanding of English and workmanlike use of words.

(iii) **General Studies** : The paper in General Studies will include knowledge of current events and of such matters as of everyday observation and experience in their scientific aspects as may be expected of an educated person. The paper will also include questions on History of India and Geography of a nature which the candidates should be able to answer without special study.

### **SYLLABUS Paper-II Electrical Engineering Part-A**

#### **Electric Circuits: Theory and Applications**

Circuit components. Average and Effective Values of Waveforms. Network graphs. KCL, KVL, Nodal analysis, Mesh analysis, basic network theorems and applications. Transient analysis, RL, RC and RLC circuits, Sinusoidal steady state analysis; series and parallel resonant circuits and applications. Coupled circuits and applications. Three phase circuits. Two-port networks. Driving point and transfer impedances. poles and zeros of network functions. Elements of networks synthesis, Filter-theory, design and applications.

#### **Signals & Systems**

Representation of continuous-time and discrete-time signals & systems, LTI systems, convolution, impulse response, time-domain analysis of LTI systems based on convolution and differential/difference equations.

Fourier transform, Laplace transform, Z-transform, Transfer function. Sampling and recovery of signals DFT, FFT Processing of analog signals through discrete-time systems.

## **Electromagnetic Field Theory**

Static Electric and Magnetic fields, Gauss's Law and Amperes Law, Fields in dielectrics, conductors and magnetic materials. Maxwell's equations. Time varying Electromagnetic fields. Plane-Wave propagating in dielectric and conducting media. Wave guide propagation with dispersion, Transmission lines.

Radiation of Electromagnetic Waves, Short dipole, Long dipole and magnetic dipole antenna. Antenna arrays.

## **Electrical Engineering Materials**

Electrical/electronic behaviour of materials, conductivity; free-electrons and band-theory; intrinsic and extrinsic semiconductor, p-n junction; solar cells, super-conductivity. Dielectric behaviour of materials; polarization phenomena; piezo-electric phenomena. Magnetic materials, Ferro and ferri magnetism.. Hall effect and its applications Photonic materials: refractive index, absorption and emission of light, optical fibres, lasers and opto-electronic materials.

## **Electrical Measurements and Instrumentation**

Error analysis, measurement of current, Voltage, Power, Power-factor and Energy. Indicating instruments. Measurement of resistance, inductance, Capacitance and frequency. Bridge measurements. Electronic measuring instruments. Digital Voltmeter and frequency counter. Transducers and their applications to the measurement of non-electrical quantities like temperature, pressure, flow-rate displacement, acceleration, noise level etc. Data acquisition systems. A/D and D/A converters.

## **Control Systems**

Mathematical modeling of physical systems. Block diagrams and signal flow graphs and their reduction. Time domain and frequency domain analysis of linear dynamical system. Errors for different type of inputs and stability criteria for feedback systems. Stability analysis using Routh-Hurwitz array, Root locus, Nyquist plot and Bode plot. and the estimation of gain and phase margin.

Basic concepts of compensator design, design of lead-lag compensators. Proportional, PI, PID controllers. State-variable representation and analysis of control systems. Principles of discrete-control systems. Stability of sample data system.

Non-linear control analysis: Describing Function Method, Phase Plane Analysis, Liapunov Method.

Control system components, electromechanical, hydraulic, pneumatic components.

## **Paper-II-Part-B**

### **Electrical Machines**

Principles of electromechanical energy conversion: Torque and emf in rotating machines.

Magnetic Circuits, Analysis and design of power transformers, construction and testing, equivalent circuits. Losses and efficiency. regulation. auto-transformer, 3-phase transformer. Parallel operation.

D.C. Machines, Construction, excitation methods. circuit models, armature reaction and commutation. characteristics and performance analysis of generators and motors, starting and speed control. Testing, losses and efficiency.

Synchronous Machines, construction, circuit model, operating characteristics and performance analysis. synchronous reactance, efficiency. Voltage regulation. Salient-pole machine, Parallel operation. Hunting.

Induction Machines. Construction and principle of operation, Characteristics and performance analysis, determination of circuit model, circle diagram, starting and speed control, cogging and crawling

Special machines- Stepper motors, brushless dc motors, permanent magnet motors single-phase motors.

### **Power Electronics and Electric Drives**

Semiconductor power devices, thyristor, triac, GTO, MOSFET, IGBT—static characteristics and principles of operation, triggering circuits, phase control rectifiers.

Bridge converters, fully-controlled and half-controlled. Principles of inverters, single-phase and 3-phase. Pulse width modulation. Sinusoidal modulation with uniform sampling. Switched mode power supplies.

Choppers and their application. Basic concepts of speed control of dc and ac motor drives applications of variable-speed drives.

### **Electrical Power Systems**

Types of power stations, Hydro, Thermal and Nuclear Stations. Pumped storage plants. Economics and operating factors.

Steady-state performance of overhead transmission lines and cables, Ferranti effect, Types of Insulators, string efficiency, corona, principles of active and reactive power transfer and distribution, per-unit quantities; bus admittance and impedance matrices, load flow; voltage control and power factor correction; economic operation; symmetrical components, analysis of symmetrical and unsymmetrical faults. Concept of system stability: swing curves and equal area criterion. Static VAR system. Basic concepts of HVDC transmission; FACTS.. Active power control: Speed control of generators, tie-line control, frequency control, VAR control, Economic dispatch Principles of overcurrent, differential and distance protection. Concept of solid state relays.

Computer aided protection- Introduction; line, bus, generator, transformer protection; Operation of various types of Circuit breakers

### **Non-conventional Energy Sources and Energy Management**

Introduction to the energy problem, difficulties with conventional energy sources. Wind-Energy: Basics of Wind turbine aerodynamics; wind-energy conversion systems and their integration into electrical grid.

Solar-Energy, Thermal conversion: photo-voltaic conversion. Wave-energy. Importance of Energy Management: Energy audit; energy economics : discount rate, payback period, internal rate of return, life cycle costing.

### **Analog and Digital Electronics and Circuits**

Characteristics and equivalent circuits (large and small-signal) of Diode, BJT, JFET and MOSFET. Diode circuits, clipping, clamping, rectifier, Biasing and bias stability. FET amplifiers, single and multi-stage, differential, operational, feedback and power. Analysis of amplifiers, frequency-response of amplifiers.

OPAMP circuits. Filters, Sinusoidal oscillators, criterion for oscillation, single-transistor and OPAMP configurations, Function generators and wave-shaping circuits. Power supplies.

Boolean algebra, minimisation of Boolean functions, logic gates, digital IC families (DTL, TTL, ECL, MOS, CMOS). Combinational circuits, arithmetic circuits, code converters, multiplexers and decoders. Sequential circuits, latches and flip-flops, counters and shift-registers. Comparators, timers, multivibrators. Sample and hold circuits, ADCs and DACs. Semiconductor memories. Logic implementation using programmable devices.

### **Microprocessors and microcomputers**

8-bit microprocessor- Architecture, CPU, module design, memory interfacing, I/O, Peripheral controllers, Multiprocessing, Programming, Advanced microprocessors. Introduction to Microcontroller.

### **Analog Communication**

Random variables, continuous, discrete, probability, probability functions. Statistical averages, probability models, Random signals and noise, white noise, noise equivalent bandwidth, signal transmission with noise, signal to noise ratio. Linear CW modulation: Amplitude modulation, DSB, DSB-SC and SSB. Modulators and Demodulators, Phase and Frequency modulation, PM & FM signals, narrowband FM, generation & detection of FM and PM, Deemphasis, Preemphasis. CW modulation system: Superhetrodyne receivers, AM receivers, communication receivers, FM receivers, phase locked loop, SSB receiver, Signal to noise ratio calculation for AM and FM receivers

### **Digital Communication**

Pulse code modulation (PCM), differential pulse code modulation (DPCM), delta modulation (DM), Digital modulation and demodulation schemes: amplitude, phase and frequency keying schemes (ASK, PSK, FSK). Error control coding: error detection and correction, linear block codes, convolution codes. Information measure and source coding. Data networks, 7-layer architecture