

## ODISHA PUBLIC SERVICE COMMISSION

Website:-<http://opsc.gov.in>&[opsconline.gov.in](http://opsconline.gov.in)

### Advertisement No. 07 of 2015-16

#### Recruitment for the post of Assistant Director in Group-B of O.S. & E.S. Cadre

The last date for filling of online application for Recruitment for the post of Assistant Director in Group-B of O.S. & E.S. Cadre has been **extended upto 10.09.2015 (Thursday)** so as to provide an opportunity to the candidates who have not applied in response to the advertisement published in the website of the Commission.

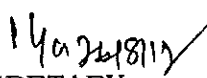
The last date of payment of Application fees at any branch of State Bank of India (SBI) is **extended upto 12.9.2015.**

For details regarding vacancy position, eligibility condition, pattern of Examination and all other important instructions, candidates are advised to visit website of OPSC at [http:// opsc.gov.in](http://opsc.gov.in) or [opsconline.gov.in](http://opsconline.gov.in).

#### How to apply:

Candidates must apply online through the website <http://opsconline.gov.in>. Applications received through any other mode would not be accepted.

Cuttack,  
DT.26.08.2015

  
SECRETARY,  
ODISHA PUBLIC SERVICE COMMISSION,  
CUTTACK.



**ODISHA PUBLIC SERVICE COMMISSION**  
**ADVERTISEMENT NO.07 OF 2015-16**

**RECRUITMENT TO THE POST OF ASSISTANT DIRECTOR IN GROUP-B OF O.S. & E.S. CADRE IN THE DIRECTORATE OF ECONOMICS AND STATISTICS, ODISHA, UNDER THE ADMINISTRATIVE CONTROL OF PLANNING AND COORDINATION DEPARTMENT.**

**WEBSITE: <http://opsconline.gov.in>**

**WARNING: (1) ONLINE APPLICATION FORM WILL BE AVAILABLE TILL 06.08.2015 BY 11:59 P.M.**

**(2) LAST DATE FOR RECEIPT OF APPLICATION FEE AT ANY SBI BRANCH IS 10.08.2015.**

Applications are invited Online through the proforma Application Form to be made available on the WEBSITE (<http://opsconline.gov.in>) from **06.07.2015 to 06.08.2015 (Note:10.08.2015 is the last date for payment of application fee)** for recruitment to the post of Assistant Director in Group-B of O.S. & E.S. cadre in the Directorate of Economics and Statistics, Odisha, under the administrative control of Planning & Coordination Department in the scale of pay of Rs.9300-34800/- carrying Grade Pay of Rs.4800/- with usual Dearness and other Allowances as may be sanctioned by the Government of Odisha from time to time.

At present, only the online applications are invited from candidates for admission to the written examination for recruitment to the post of Assistant Director in Economics & Statistics Cadre in the Directorate of Economics & Statistics. After declaration of result of written examination the candidate who qualify in the written examination will be required to furnish the printout/hard copy of online application form, alongwith the photocopies of the other documents as stated under the para-9 of this advertisement, on or before the prescribed date, which will be declared later on, for consideration of their eligibility for admission to the Viva Voce Test.

**2. VACANCY POSITION:** As per requisition filed by the Planning & Coordination Department, Government of Odisha, the vacancy position alongwith reservation thereof is given below:-

Sl. No.	Category	No. of vacancy
1.	Un-reserved	03(W-1)
2.	Scheduled Caste	01(W)
3.	Scheduled Tribe	01
	<b>Total</b>	<b>05 (W-2).</b>

**NOTE: (a)** In case of non-availability or availability of insufficient number of eligible women candidate(s) in any particular category, the unfilled vacancies of that category shall be filled up by eligible and suitable male candidate(s) of the same category.

- (b) The exchange of reservation between SC & ST will not be considered.
- (c) The number of vacancies to be filled up on the basis of this recruitment is subject to change by the Government without notice, depending upon administrative exigencies of public service at the discretion of the State Government.
- (d) The post is temporary, but likely to be made permanent. The appointment can be terminated on one month's notice from either side without assigning any reasons thereof;
- (e) The period of probation is 2 years u/r19(2) of O.S. & E.S.Rules.

3. **AGE:** A candidate must have attained the age of 21(twenty one) years and must not be above the age of 32(thirty two) years as on the 1<sup>st</sup> day of August, 2015.

The upper age-limit prescribed above shall be relaxed by 5(five) years for candidates belonging to the categories of Socially & Educationally Backward Classes(S.E.B.C.), Scheduled Castes (S.C.), Scheduled Tribes(S.T.), Women & Ex-Servicemen.

Provided that, a candidate who comes under more than one category mentioned above, he/she will be eligible for only one upper 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.**

The 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.

4. **MAIN JOB CHART:**

Full Technical Supervision, Technical Guidance & Administrative charge as per direction of Director, E. & S, Odisha, Bhubaneswar.

5. **EDUCATIONAL QUALIFICATION:**

A candidate must have obtained at least a 2<sup>nd</sup> Class Master's Degree in Economics/Applied Economics/Statistics/Applied Statistics.

Candidates who possess Master's Degree in subject other than the above subject are not eligible to apply for the post.

6. **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 the fee.

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. **METHOD OF SELECTION:**

(a) The selection of candidates for recruitment to the posts shall comprise of a written examination and a Viva Voce Test. The written examination shall comprise of four subjects. The subject of examination and the maximum marks for each subject are appended at annexure-'A'.

(b) The question in the Economics & Statistics papers (except General English and General Knowledge) are appended at Annexure-'B'.

9. **CERTIFICATES AND DOCUMENTS TO BE ATTACHED:**

Candidates who will qualify in the written examination are required to submit printout/hardcopy of the online application form alongwith the true copies of the following documents duly attested by Gazetted Officer or Notary Public or self attested. 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 of the attested copies sent earlier. For verification, failing which he/she will not be allowed to appear at the 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 the viva voce test he/she shall not be allowed to appear at the viva voce test.

- (i) H.S.C. or equivalent certificate in support of declaration of age issued by the concerned Board/Council;
- (ii) Intermediate/+2 Examination Certificate/Equivalent examination certificate issued by the concerned Board/Council;
- (iii) Bachelors Degree Certificate issued by the concerned University;
- (iv) Master's Degree certificate in the concerned discipline in respect of educational qualification prescribed for the recruitment.
- (v) (a) Two recent passport size photographs (unsigned & unattested) which has been uploaded with online application.  
(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;
- (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;
- (viii) Discharge Certificate issued by the Commanding Officer of the Unit last served wherever applicable.
- (ix) No objection Certificate issued by the competent authority.
- (x) 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:** Candidates claiming to be belonging to S.C./S.T./S.E.B.C. category of Odisha, 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 and candidates submitting such certificate will be treated as belonging to U.R. category.
- (ii) OBC CERTIFICATES ~~WILL NOT BE ACCEPTED~~ IN LIEU OF S.E.B.C. CERTIFICATES AND CANDIDATES SUBMITTING SUCH CERTIFICATE WILL BE TREATED AS U.R. CANDIDATES.

- (iii) Candidate if submits S.E.B.C. certificate which is more than three years old as on the date of advt., will be treated as belonging to UR category.
- (iv) 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, must have been issued by the competent authority within the last date fixed for submission of online application form.

**10. OTHER ELIGIBILITY CONDITIONS :**

- (i) The candidate must be a citizen of India;
- (ii) The candidate must be of good mental condition, bodily health and free from any physical defect that is likely to interfere with the discharge of his duties in the service. A candidate, who after such medical examination is not found to satisfy these requirements shall not be appointed to the service.
- (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-5 & 3 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 fulfill the requisite qualification & within the prescribed age limit etc., within the last date fixed for submission of online application form, 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.

## 11. OTHER CONDITIONS

(i) A candidate found guilty of seeking support for his/her candidature by offering illegal gratification or applying pressure or 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. Any violation of the provisions of the above Act, and violation of the instruction to candidates (as provided in the advertisement, online application form, Admission Certificate & Answer Script etc.) will be seriously viewed and disciplinary action will be taken against the concerned candidates as deemed proper.

(iii) On line Applications submitted to the OPSC, if found to be incomplete in any respect are liable to rejection without entertaining any correspondence with the applications on that score:

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

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

(vi) Concession meant for S.Cs., S.Ts. and S.E.B.Cs. by birth are admissible to the Schedule Castes, Schedule Tribes and Socially & Educationally Backward Classes of Odisha only.

**(vii) No one will be admitted to the examination unless he/she holds a certificate of admission, the eligible candidates are required to download their admission certificate from the website of the Commission & Produce the same before the Centre Supervisor for admission to the examination Centre.**

(viii) All persons appointed under the Government of Odisha on or after 1st 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 Services (Pension) Amendment Rules, 2005.

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

(x) 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;

(xi) Candidates must answer the papers in their own handwriting, in no circumstances; a candidate will be allowed the help of a scribe to write the answers for him/her.

12. **HOW TO APPLY:-**

- a. Candidate must go through this detailed Long Advertisement available in the Website of OPSC before filing up online application form.
- b. Candidates must apply online through the website <http://opsonline.gov.in>. Applications received through any other mode would not be accepted and summarily be rejected.
- c. **Before filling up the online applications form, the candidates must go through the following documents available at OPSC portal.**
  - i) **Instruction to fill up online application form,**
  - ii) **Guideline for scanning and uploading of Photograph, Full Signature & Left Hand Thumb Impression.**
- d. Candidates are requested to upload the scanned image of latest passport size photograph alongwith scanned image of his/her full signature and scanned image of Left hand Thumb Impression(LTI) in the online application form. The 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 the 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 the Online Application Form, a unique Registration ID will be displayed on the screen as well as on the top of the Application Form. Candidates are requested to note down the Unique Registration ID and use it in future correspondence.



- h. At present, only the online applications are invited from candidates for admission to the written examination, candidates who will qualify in the written test are required to send the Printout/Hard copy of the Online Application Form alongwith specified documents/certificates etc. as provided under para-9 of the long advertisement alongwith 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-753001 so as to reach the same in OPSC on or before the prescribed date, which will be declared later on (i.e. after publication of the result of written examination.) The SC/ST candidates are not required to enclosed the copy of challan showing payment of fee.

The envelope containing the application must be super scribed "application for the post of Assistant Director in Group-B of Odisha Statistics & Economics Cadre. Application received after the prescribed date shall not be entertained. The Commission will not take any responsibility if the application is not received in time.

- (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) Admission Certificates of the eligible candidates will be uploaded in the website of the OPSC prior to the date of written examination and V.V. test which will be published in the website of OPSC and news paper. The candidates are required download their Admission Certificate from the website. No separate correspondence will be made on this score.

### **13. FACILITATION COUNTER:**

During filling up the online application form the candidate may contact facilitation counter of OCAC over Telephone No.18003456770 or 155335 from 10.00 A.M. to 5.00 P.M. (Except Govt. of Odisha holidays) for any technical guidance.

Regarding difficulty in payment of fee, if any, the candidates may contact to SBI over Telephone No.:0671-2368262 & 9437039604.

In case of any guidance/information on this advertisement and recruitment, candidates may contact the O.P.S.C. Facilitation Counter over **Telephone No. 0671-2304141/2305611 & Extn.-223 & 205** on 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://opsonline.gov.in> OR <http://opsc.gov.in>** for detailed information about rejection notice/the programme of the examination(s) and v.v.test etc. and also keep track of publication of various notices to the effect in the leading local daily news papers for information.

C U T T A C K

DATED :29.06.2015

SECRETARY,

ODISHA PUBLIC SERVICE COMMISSION,  
CUTTACK.

Subjects

Maximum Marks

1. All subjects are compulsory (One paper in each subject)

(i)	General English	-	100
(ii)	General Knowledge	-	100
(iii)	Statistics	-	300
(iv)	Economics	-	300
	Viva Voce Test	-	100

2. The maximum marks for written examination are, thus 800. The viva voce test shall carry 100 marks.

3. The question in General English & General Knowledge papers shall be of such standard as shall be prescribed by the Commission. The question in Statistics and Economics papers shall be of Post-Graduate standard.

4. Papers(i) & (ii) shall be of 2 hours duration each and (iii) & (iv) shall be of 3 hours duration each. There is no time limit for viva voce test.

5. A candidate shall answer the papers in English unless otherwise directed.

6. The Commission shall summon for the viva voce test all candidates who have appeared at the written test and have secured the minimum qualifying marks to be prescribed by the Commission at their discretion, in any or all of the subjects.

7. If a candidate's hand writing is not easily legible, deduction which may be to the extent of ten per cent of the marks otherwise accruing to him may be made.

8. From the marks assigned to a candidate in cash subject such deduction may be made as the Commission may consider necessary in order to ensure that no credit is allowed for merely superficial knowledge.

9. Credit shall be given for orderly, effective and exact expressions combined with economy of words and persuasiveness of argument.

10. The candidate will be interviewed by the Commission who will have before them a record of his career. The Commission may, if they consider if necessary, secure the assistance of experts and to subject of expires will be at their discretion. The candidate may be asked questions on any subject studied by him for the bachelors or Masters Degree examination as well as on matters of general interest. The object of the interview is to asses his suitability for the service with particular reference to his intelligence and alertness of mind and the range of his outlook.

## SYLLABUS Economics

### Module:-1

Theory of Consumer Behavior- cardinal utility analysis, theory of demand, Indifference curve analysis, price, Income and substitution effects Slutsky theorem, Revealed Preference theory, Revision of demand theory by Hicks, Consumer's choice under risk and uncertainty, Newman-Morgenstern utility function, duality theory, consumer's surplus.

### Module:-2

Production function- short period and long period, forms of production function, Cobb-Douglas, CES production functions and their properties, Laws of Returns, Returns to Scale, duality and cost function, measures of productive efficiency of firms, technical and allocative efficiency, partial versus general equilibrium approach, equilibrium of the firm and industry. Product and Factor Pricing- pricing under different market structures, marginal pricing, Marshallian and Walrasian stability analysis, with incomplete information and moral hazard problems.

### Module:-3

Concept of National income and social accounting- measurement of national income, circular flow of income in two, three and four-sector economy, different forms of national income accounting, given national income. Theory of Employment, Output, Inflation & Money- the Classical theory of employment and output, Keynes' Psychological law, Keynes theory of employment and output, post-Keynesian developments, Demand-pull and cost-push inflation, the Philip's curve, its policy implications, classical theory of money, quantity theory of money, Friedman's restatement of quantity theory, Keynes' theory of demand for money, Post-Keynesian approaches to demand for money.

### Module:-4

Economic growth and Development-concepts of growth and development and their measurement, characteristics of less development countries and obstacles to their development, growth, poverty and income distribution, Classical and neo-classical approach to growth, growth models of Harrod and Domar, Solow, Meade, Joan Robinson, Utilitarian and Welfarist approach to social development, A.K.Sen's critique. Sen's capability approach to economic development, the Human Development Index, Physical Quality of Life Index and Human Poverty Index.

### Module:-5

Time series and Index numbers: Components of a time series. Trend-methods of trend fitting, Seasonal components. Measurement of seasonals. Basic ideas on auto-regression. First order auto-regressive series. Index

numbers- criteria of a good index number. Problems in data collection and construction. Price and cost of living index numbers. Base shifting and splicing, Deflating of index numbers.

**Module:-6**

International Economics-Gains from international trade, terms of trade, International trade and economic development, theories of International trade; Ricardo, Haberier, hecksher-Ohlin. Disequilibrium in Balance of Payments, mechanism of adjustments, exchange control and multiple exchange rate, Global agencies dealing with international trade and finance; IMF, World Bank, WTO, MNCs.

**Module:-7**

History of Development and Planning- alternative development strategies, goal of self reliance based on import substitution and protection, post-1991 globalization strategies based on stabilization and structural adjustment, fiscal reforms, financial sector reforms, Regional Planning, Planning Commission, National Development Council.

**Module:-8**

Institutional structure-land reforms in India, technological changes in agriculture, pricing of agricultural input and output, agricultural finance policy, agricultural marketing and warehousing, issues on food security, policy for sustainable agriculture.

Industrial policy reforms, public sector enterprises and their performance, privatization and disinvestment debate, growth and pattern of Industrialization, sources of industrial finance, foreign direct investment, role of foreign capital for direct investment and portfolio investment.

**Module:-9**

Poverty, unemployment and human development-estimates of inequality and poverty measures in India, unemployment and under-employment, rural development programmes including poverty alleviation programmes, development of social and economic infrastructure. India's human development record in global perspective, India's population policy and development.

**Module:-10**

Fiscal federalism in India; vertical and horizontal imbalance, assignment of function and sources of revenue, constitutional provision, Finance Commissions, devolution of resources and grants and criteria for transfer of resources, centre-state financial relations in India; problems of states' resources; financial aspects of 73<sup>rd</sup> and 74<sup>th</sup> constitutional amendments.

## Statistics

### Module:- 1

Probability: Random variables, Expectation, Independence, Convergence in probability, Convergence in law, Sequence of random variables, Distribution function, Convergence in distribution, Markov, Chebycheff and Kolmogorov inequalities, Weak and Strong laws of large numbers, Characteristic functions, Inversion and Uniqueness theorems of characteristic functions, Central limit theorem (Lindberg-Levy).

Stochastic process: Markov processes in continuous time: Poisson processes, Birth and Death processes.

### Module:- 2

Correlation and Regression analysis: Linear, Partial and multiple Correlation, their properties and applications, Linear and multiple Regression Analysis: Assumptions involved, Violations of assumptions and remedies.

Association of attributes: Coefficients of association and their interpretations, Analysis of categorical data.

Analysis of variations in Time series and forecasting, Periodogram and Harmonic Analysis, Serial correlation, Correlogram.

### Module:- 3

Sampling Techniques and Design of Experiments: Census versus Sample Survey, Role of NSS organization, Simple Random Sampling, Stratified Sampling, Systematic Sampling, Ratio and Regression estimates. Principles of Design of Experiment, Completely randomized, Randomised block and Latin Square Designs.

### Module:-4

Demography and Vital Statistics: The life table, its constitution and properties, Abridged and UN model life table, Stable and Stationary populations. Different birth rates, Total fertility rate, Gross and Net Production Rate, Different mortality rates, Standardised death rates, Infant mortality and maternal mortality rate, Age at marriage: Hajnals methods, Projection methods including Logistic curve fitting, Decennial population census in India.

### Module:- 5

Numerical Analysis: Interpolation formulae (with remainder terms) due to Lagrange, Newton-Gregory, Newton Divided different, Gauss and Stirling. Euler-Maclaurin's summation formula. Inverse interpolation. Numerical integration and differentiation. Difference equations of the first order. Linear difference equations with constant coefficients.

2

Module:- 6

Computer Application & Data Processing:

Computer system concepts: Components System components and Functions, Central processing unit, Main memory, Bit, Byte, Word, Input/output devices, speeds and memory capacity. Software concepts: Overview of operating systems: Types and Functions of operating systems, application software, Batch and time sharing mode, Overview of existing software Packages on Word processing and spreadsheets. Flowcharts, Basic of Algorithm, Fundamentals of Design and Analysis of Algorithm, Basics of Data Structure. Binary representation of integers and real numbers, Logical data element.

Module:- 7

Multivariate normal distribution, Hotelling's T-square and Mahalanobis D-square statistics and their applications, Multivariate analytical tools: Cluster analysis, Discriminant function and discriminant analysis, Principal components and analysis.

Linear programming: Formulation and graphical solution, Simplex method, Duality, Transportation and assignment problems.

Module:- 8

Analysis of variance: Fixed, random and mixed models, Analysis of one way and two way classified data, Multiple comparison procedures, Principles of experimentation, Complete and incomplete block designs, Balanced Incomplete Block design-Intrablock analysis and analysis with recovery of interblock information, Construction of Balanced incomplete designs, Lattice designs, Factorial experiments-Analysis with and without confounding (total and partial), Split plot and Strip plot designs, Response surface designs.

Module:- 9

Statistical Inference: Sampling and sampling distributions, Problems of estimation-point estimation and interval estimation, Properties of estimators-Unbiasedness, Consistency, Sufficiency and Efficiency, Different methods of estimation, Properties of maximum variance estimator, Minimal sufficiency, Rao-Blackwell theorem, Completeness and bounded completeness, Ancillaries, Confidence Interval-shortest confidence interval. Elements of decision theory and Bayesian inference.

**Module:- 10**

Testing of Hypothesis: Simple and composite hypotheses: Neyman-Pearson Lemma and its application, Uniformly most powerful test, Unbiased tests, Similar region, Conditional tests, Likelihood ratio tests, Non-parametric tests (One sample and two sample case): Sign, Median, Run, Wilcoxon signed-rank test, Mann-Whitney U-test, Kolmogorov-Smirnov tests, Derivation of mean and variance and applications and their asymptotic properties.