



NATIONAL INSTITUTE OF FOOD TECHNOLOGY ENTREPRENEURSHIP AND MANAGEMENT

Deemed to be University (De-novo Category) under Section 3 of the UGC Act, 1956
An Autonomous Institution under Ministry of Food Processing Industries, Govt. of India, Sonapat

F. No. N/S/K/1546/2018/291

Dated: 07.06.2019

Notice

Subject: Recruitment Notification - Advertisement No. N/S/K/1546/2018 dated 24.04.2018 for the post of Junior Analyst for Food Testing Lab (FTL) Syllabus for the Objective Test – Reg.

Dear Candidate,

With reference your application for the post of Junior Analyst for Food Testing Lab (FTL), it is informed the Selection Process provides scheme of Examination as under:

Scheme of Examination: Objective (multiple choice OMR/Computer based) test comprising of 100 questions of one mark each.

Test	Number of Multiple choice questions	Duration of Test
Subject area (Food processing/ Testing and related subjects)	50	60 minutes
General Intelligence & Reasoning	15	60 minutes
General Awareness	10	
Quantitative Aptitude	10	
English Comprehension	15	

There will be negative marking of 0.25 for each wrong answer.

Merit list will be drawn with 50% weightage of the marks obtained in score card and objective test taken together. In case two or more candidates secure same marks (i.e. score card + objective), the tie will be resolved by the following procedures:

- On the basis of date of birth with older candidate placed higher in merit failing which;
- Alphabetical order of first letter of name of the candidates placed higher in merit.

The Syllabus for Subject Area of Food Processing, Testing and related subjects is given in the Annexure for the Objective type test.

The Objective Type test as indicated above is likely to be conducted at the end of June, 2019. The date of Examination would be notified in advance in the website of NIFTEM.

Encl: As above


Registrar

Advertisement No. N/S/K/1546/2018, Dated: 24-04-2018

Post- Junior Analyst (JA)- FTL

List of Eligible Candidates

Sr. No.	Application No.	Name (Sh./Ms.)
1	JA-01	Anil Kumar Saw
2	JA-02	Roshan Kumar
3	JA-04	Manjit Singh
4	JA-09	Rishi Bhatia
5	JA-10	Suman Soni
6	JA-13	Ruchi Tyagi
7	JA-14	Sabir Ali
8	JA-17	Nidhi
9	JA-19	Sandeep Kumar Yadav
10	JA-20	Gunjan Kumar
11	JA-25	Satish Chandra Kushwaha
12	JA-26	Vikas Kumar
13	JA-27	Gulveer Chaudhary
14	JA-28	Rambabu Bandaru
15	JA-30	Nehulkumar Maheshbhai Shrigod
16	JA-36	Mohita Sahu
17	JA-37	Niraj
18	JA-42	Jai Shankar Prasad
19	JA-43	Ankur Kumar
20	JA-44	Anupama Deora

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MANAGEMENT**

SYLLABUS FOR SUBJECT PAPER For JUNIOR ANALYST ENTERANCE EXAM

1. Food Laws and Standards of India and International Food Laws:

- a) Licensing and registration: Central license, State license, Registration, Responsibilities of the FBO, Role of Designated officer, Food Safety Officer and Food Analyst.
- b) Standards of Quality and Safety of Food & Food Products laid down in the FSS Regulations, 2011. The different food categories in the Act. The relevance of the standards (Vertical and Horizontal) quality and safety parameters to particular foods including current food safety issues.
- c) Regulations of food additive: What is an additive, various groups of additives and their technological functions, INS number: food colors, antioxidants, sweeteners, preservatives, processing aids. Food processing aids. The Indian Food Code and using the hierarchy to understand the category wise approval of Food additives.
- d) Packaging and labelling rules and regulations: List of ingredients, nutritional information, special label declarations, claims-Health, nutrition, nutrient led claims, use of words and phrases on label
- e) Regulations for Contaminants, Toxins and Residues and restriction of sales.
- f) Food Safety and Standards (Food or Health Supplements, Nutraceuticals, Foods for Special Dietary Uses, Foods for Special Medical Purpose, Functional Foods and Novel Food) Regulations, 2016 Food Safety and Standards (Food Recall Procedure) Regulation, 2017 Food Safety and Standards (Import) Regulation, 2017
- g) Laboratory sampling and analysis: The role of Referral labs. Storage of sample. Required documentation and registration, storage of the sample Analyses as per FSS Rules and Regulations (2011).
regard to Food Safety:
CODEX Alimentarius Commission: History, Members, Standard setting and Advisory mechanisms: JECFA, JEMRA, JMPR

2. Accreditation of laboratory including NABL /ISO / IEC-17025: 2017 and laboratory safety.

II. What is accreditation, Different accreditation bodies (NABL, APLAC, ILAC). Requirements for ISO/IEC 17025:2017, documentation, pre-requisites for accreditation, management requirements, technical requirements, measurement of traceability

III. Laboratory safety: Personnel and laboratory hygiene, emergency planning, General hazards in a food laboratory, safety equipment, storage of chemicals, acids, flammables

etc. handling compressed gases, centrifuge, chemical and biological spills and waste disposal.

3. Principles of Food Preservation, Processing and Packaging.

I. Food Processing Operations: Manufacturing processes: batch, Semi-batch and continuous
Cleaning of raw materials: cleaning methods and contaminations, Size reduction and screening of solids: equipment, modes of operation. Disintegration of materials: slicing, dicing, shredding, pulping. Mixing and emulsification. Filtration and membrane separation: principles, design features and general applications
Centrifugation: principles and applications. Solid-liquid extraction and expression. Sorting and grading of foods: weight, size, shape, buoyancy, photometry sorting

II. Food Preservation by

- a) Heat: Principles of Heat Transfer, Blanching, Pasteurization, Heat Sterilization, thermal extrusion, cooking
- b) Water Removal: Forms of Water in Foods, Sorption of Water in Foods, Water Activity, Drying and Evaporation Technology
- c) Temperature Reduction: Chilling, Freezing
- d) Radiation: Ionizing Radiation, Microwave
- e) By use chemicals: Class-I and Class-II preservatives, smoke other Chemical Additives
- f) New non-thermal methods: high hydrostatic pressure, modified atmosphere, high-intensity pulsed electric fields, intense pulsed light, oscillating magnetic fields), hurdle technology, ultrasonic and ohmic heating etc.

III. Food Packaging:

- a) Effect of Environment on Food Stability: Light, Oxygen, Water, Temperature, Sensitivity to Mechanical Damage and attack by biological agents
- b) Different packaging materials used for food packaging and their properties –including barrier properties, strength properties, optical properties: Glass, Metals, Paper, Plastics, Biodegradable and Edible Films and Coatings, aseptic packaging and Combinations.
- c) Selection of packaging material and design for various food commodities including fresh produce (fruits and vegetables), milk and milk products (dairy), cereal, pulses, oil, meat, fish, poultry, water and processed foods.
- d) Evaluation of quality and safety of packaging materials – different testing procedures
- e) Functions of Packaging: Protective Packaging and active packaging smart and intelligent packaging.
- f) Newer packaging technologies- CAP/MAP packaging, aseptic processing and packaging, irradiated packaging, retort pouch, microwaveable packaging.

4. Principles and Basics of Human Nutrition

a) Water: sources, body's needs, physiologic function

b) Body composition, Energy metabolism and nutritional requirements of the body, Recommended daily allowance (RDA), Basic metabolic rate (BMR)

c) Carbohydrates: Digestion of Simple and complex carbohydrates, dietary fibre, absorption of glucose, carbohydrate metabolism, Diabetes.

d) Lipids: Triglycerides, digestion, absorption, and transport, essential fatty acids (EFA), metabolism of fats, Cholesterol role in cardiovascular disease

e) Protein: Essential and nonessential amino acids, digestion and absorption of protein, protein metabolism, protein quality (biological value, protein efficiency ratio, net protein utilization intake and role in the body.

f) Vitamins: Deficiency diseases toxicity, sources, and function.

g) Minerals: Major and minor minerals nutritional significance and physiological role of dietary calcium, phosphorus, magnesium, iron, iodine, zinc and copper, selenium. (their dietary sources and deficiencies).

h) Macronutrient deficiency diseases, Overnutrition, Undernutrition, Malnutrition (Kwashiorkor & Marasmus)

i) Food allergens, Allergenicity and Inborn errors of metabolism

j) Diet and Health: Diabetes, cancer, stroke, hypertension, heart health

5. Food Chemistry

I. Water: Water as a nutrient, function, sources, requirement, structure, water balance – effect Moisture in food: Hydrogen bonding, cohesion and adhesion properties, specific heat, osmosis colloidal properties of foods. Acid-base balance, pH, Hydrogen ion concentration, Buffers and Henderson Hasselbach equation.

II. Carbohydrates: Nomenclature and different methods of classification, structure and chemical properties of monosaccharide, disaccharides and polysaccharides and complex carbohydrates; amino sugars, proteoglycans and glycoproteins. Reducing and non-reducing sugars, Optical and stereoisomerism. Different Color reactions of carbohydrate. Changes in carbohydrates during processing. Maillard reaction

III. Proteins and amino acids: Classification of amino acids based on structure; aromatic, aliphatic, acidic, basic, sulfur-containing, branched chain, essential and non-essential amino acids. Globular & Fibrous protein, Hierarchy in structure (primary, secondary, tertiary), isoelectric point, Protein denaturation, digestibility. Colour reactions of proteins and amino acids. Amino acid analysis, protein digestibility corrected amino acid score (PDCAAS). Rheological properties of protein- solubility, viscosity, gelling, surfactants/

IV. Lipids: Classification, nomenclature, structure, properties and functions of fatty acids, fats, phospholipids, sphingolipids, cerebrosides, steroids, cholesterol, plant sterols, bile acids, prostaglandins, lipoamino acids, lipoproteins, proteolipids, lipopolysaccharides. Reactions of lipids, oxidative and hydrolytic rancidity. Different types of fats uses in food processing, food emulsions, fat replacers, esterified fats. Changes during food processing. Protein-lipid interaction, Lipid Carbohydrate interaction, Lipid-Lipid interaction. Fatty acid analysis and composition

V. Vitamins: Water- and fat-soluble vitamins: Effect of various processing treatments and fortification of foods.

VI. Food Additives: Chemistry, Function and application of Preservatives, Emulsifying and Stabilizing agents, Sweeteners, buffering agents, bleaching, maturing agents and starch modifiers, Food colours, flavours, anti-caking agent, Antioxidants etc. The nature, properties and functions and mode of action. Safety assessment of Food additives: No-observed Effect Level (NOEL Acceptable daily intake (ADI), Dietary exposure,) in chronic toxicity studies

VII. Antinutritional Factors: Protease Inhibitors, Haemagglutinins (Lectins), Glucosinolates, Cyanogens, Saponins, Gossypol, Lathyragens, Antivitamins, Antiminerals, Bitter substances, tannins and their removal from foods.

VIII. Food Enzymes: Properties, classification, enzyme units, Role in foods: Beta-galactosidase, alpha-galactosidase, proteases (papain, bromelain), lipases, oxidases etc, Polyphenol oxidase, enzymatic and non-enzymatic browning.

IX. Nucleic Acids: DNA: Physical and chemical properties (renaturation and denaturation). Structure of nitrogenous bases, nucleosides, nucleotides, RNA Classes; mRNA, tRNA and rRNA.

X. Nutraceuticals and Functional Foods: Definition and function of Nutraceuticals, Functional Foods, Food Supplements, Dietary supplements prebiotics and probiotics, Medical foods and foods for special purposes, examples Phenylalanine free diet for Phenylketonuria patients, Lactose-free for Lactose intolerant.

XI. Plant pigments: Structure and function of Chlorophylls, lycopene, betalaine, curcuminoids, annatto, Carotenoids, anthocyanins, flavonoids, melanin, tannins, quinones, and xanthone. And roles in the food industry.

XII. Radioisotopes: Origin and properties of radioactivity. Detection and measurement of radioactivity, Geiger-Muller Counter, and types of scintillation counters and counting, Scintillation counting of γ ray, Concept of dpm and cpm. Applications of irradiation in food preservation/safety. Safety rules for handling radioactive materials

XIII. Genetically modified organism (GMOs): What are GMOs? Which are the major GMOs in food and what are the traits that have been engineered. How to detect and quantify GMOs.

XIV. Food contaminant and adulterants: Major Classes of Pesticide and their residues, Heavy metals, Antibiotic & hormone residues, Veterinary drug residue, other new contaminants and toxins (For example: Cyclopiazonic acid in Buckwheat flour), radioactive nuclides, mycotoxins (Aflatoxin, Ochratoxin, Patulin, DON, Ochratoxins, Sterigmatocystin, Fumonisin, Zearalenone). Common Adulterants: Lead chromate,

mineral oil, urea, SDS, starch, blotting paper, metanil yellow, Rhodamineargemone, khesari dal, brick power etc.)

6. Food Microbiology & Food Hygiene

I. Introduction to Food microbiology: Classification and nomenclature of microorganisms. Morphology and Structure of Microorganisms in Foods (Yeasts and Molds, Bacterial Cells Viruses). Important genera of Mold, yeast, bacteria (gram-negative aerobes and facultative anaerobes, gram-positive cocci, endospore-forming rods, non-sporulating), bacterial groups (lactic acid, acetic acid, butyric acid etc), thermophilic, proteolytic, saccharomycetic etc, coliforms, faecal coliforms, enteric pathogens. Emerging microbes.

II. Sources of microorganisms in the food chain (raw materials, water, air, equipment etc) and microbiological quality of foods

III. Microbial Growth Characteristics: Reproduction and growth (fission, generation time optimum growth, growth curve etc). Microbial growth in foods: Intrinsic (pH, Moisture Content, Oxidation–Reduction Potential, Nutrient Content, Antimicrobial Constituents) and Extrinsic Parameters (Temperature of Storage, Relative Humidity of Environment, Presence and Concentration of Gases in the Environment).

IV. Thermal Destruction of Microorganisms, Thermal Death Time, D Value, zValue, F Value, Thermal Death Time Curve, 12 D Concept.

V. Microbial food spoilage and Foodborne diseases, food pathogens *Aeromonas hydrophilia*, *Bacillus cereus* and other *Bacillus* Species, *Brucella*, *Campylobacter*, *Clostridium botulinum*, *Clostridium perfringens*, *Enterobactersakazakii*, *Escherichia coli*, *Listeria monocytogenes*, *Salmonella*, *Shigella*, *Staphylococcus aureus*, *Vibrio*, *Yersinia enterocolitica*, Fungi, virus etc

VI. Methods for the Microbiological Examination of Foods: Sampling Two-class and three-class sampling plan. Pure culture isolation: Streaking, serial dilution and plating methods; cultivation, maintenance and preservation/stocking of pure cultures; cultivation of anaerobic bacteria, and accessing non-culturable bacteria. Indicator Organisms: Direct Examination, Enumeration Methods, Plate Counts, Most Probable Number Counts, biochemical test, Rapid Methods for Detection of Specific Organisms and Toxins, Immunological Methods, DNA/RNA Methodology

VII. HACCP and Food Safety Management Systems: ISO 22000: Importance of implementing a HACCP system. HACCP Principles. Some Limitations of HACCP Food

Safety Objective (FSO). Good Manufacturing Practices (GMP) Good Hygienic Practices (GHP).

7. Physical, Chemical and Instrumental analysis

I. Sampling and sample preparation: Definition, types of sample, sampling plan, subsampling, designing a sampling plan, concept of sample size and representative. Sample preparations – particle size, homogeneity, dissolution technology and decomposition, storage of samples. Solid Phase Extraction- Introduction, sorbents, matrix solid phase dispersion and applications.

II. Statistics and statistical terms: Systematic and random errors. Mean distribution, Confidence interval, Confidence limits and confidence level. Outliers. Definition and calculation of: Average, Mean, Standard deviation, Relative standard deviation, Coefficient of variation, Confidence limits of measurement, Statistical Tests, Linear correlation and regression curve fitting, fitting of linear equations. Choosing and using statistical tests, Analysis of Variance (ANOVA).

III. Basic principles of Classical Methods of food analysis: Law of mass action, Le chateliers principle, stoichiometry, volumetric and gravimetric analysis. Preparation of standards, working standards and solutions of known concentration (percent, molar, molal, normal, ppm and ppb) and their dilution. Proximate analysis, physical methods for extraneous matter analysis

IV. Classical analytical techniques: Gravimetry, Titrimetry, Refractometry and Polarimetry: Principle, Instrumentation and applications of each technique in food analysis

V. UV-Visible and fluorescence spectrometry. Components and functioning of an UV-vis spectrophotometer: Single beam and double beam. Components of a UV-VIS spectrum. Calibration curve and applications in food analysis. λ : Electromagnetic spectrum, Beer and Lambert's Law, Absorbance, Transmittance, Molar absorptivity (Molar Extinction coefficient), E 1%,

VII. Chromatographic techniques: Fundamentals of chromatographic separations and their classification. The plate theory. Capacity factor and resolution factor. Chromatographic efficiency. Partition coefficient etc. Principles and applications of paper (Ascending, Descending, Radial, Two dimensional) Partition, Thin layer chromatography, HPTLC, size exclusion and ion exchange chromatography. Applications in food analysis

VIII. High Performance Liquid Chromatography (HPLC): Basics of liquid chromatography, HPLC columns and Stationary phases (solid, liquid) – Bonded phase supports, mobile phases, isocratic and gradient elution, Detectors: UV absorption, Fluorescence detector, RI detectors, electrochemical detectors, Photo diode array, Evaporative light scattering detector, PHRED anatomy of a chromatograms. Modes of separation Normal and Reverse Phase. Sample Preparation Techniques, Applications in quantitative food analysis of aflatoxins, vitamins, sugars, sweeteners, preservatives etc.

IX. Gas chromatography: Basics of Gas chromatography, Mobile phase and criteria for its selection – Sample introduction techniques – Stationary phases– Supports for liquid stationary phases, Selection of columns. Detectors FID, TCD, FPB, ECD, TID. Temperature programming in GC – Derivatization and sample preparation in GC –Fatty acid profile and quantitative analysis of fatty acids in fats and oils.

X. Mass Spectrometry: Basics of mass spectrometry, Components of a mass spectrometer, Ionization and ion sources: Electrospray, chemical, Fast Atom Bombardment, MALDI, Atmospheric Pressure Chemical ionization and other ionization methods. Mass analyzers: Quadrupole Analyzers, Ion Trap Analyzers. Tandem Mass Spectrometry and its applications.

XI. Hyphenated Techniques: Mass Spectrometry and Chromatography Coupling. GC-MS/MS, LC-MS/MS, Capillary electrophoresis-MS, Isotopic Ratio mass spectrometry. Analytical Information: Mass Spectrometry Spectral Collections, high resolution, quantitative data, fragmentation and spectrum interpretation.

XII. Atomic absorption Spectroscopy, Atomic emission spectroscopy, ICP-MS: Principles-Atomization process, Atomic line widths and radiation sources for AAS, temperature gradients, cells detectors, interferences, Atomic Emission Spectroscopy: Atomic spectra, Spectrometers, Merits, demerits, and applications. Basic principles and instrumentation of ICP-MS; data acquisition and interpretation; applications of ICP-MS for analysis of metallic contaminants in food. Sample preparation, microwave digestion.

XIII. Biological Techniques (DNA/protein-based): Fundamental principles and instrumentation of the systems; measurement techniques and result interpretations of

Polymerase Chain Reaction (PCR), Real-time Polymerase Chain Reaction (PCR) technique; Enzyme Linked Immunosorbent Assay (ELISA); Radioimmunoassay (RIA). Use of PCR for detection of genetically-modified organisms (GMO); meat and fish speciation and other applications in analysis of food adulteration.

XIV. *Measurements of Rheological properties:* Instrumental Measurement of Texture of Foods, Visco Analysis, viscometer, texture analyser etc.

XV. *Quality assurance and Quality control:* Introduction to quality control in analytical chemistry. Terminology in analytical measurements: True value, Measured value, Accuracy, Precision, Uncertainty, Random errors, Sample traceability, Internal quality control, Certified reference materials, Spiked reference samples, Recovery studies, Method validation/verification (LOD, LOQ, specificity, selectivity, linearity, range, robustness, repeatability, reproducibility, External and internal standards, Control chart, Proficiency testing, z scores