



# TAMIL NADU PUBLIC SERVICE COMMISSION

Advertisement No.734

Notification No. 04/ 2026

Date: 20.05.2026

## Combined Technical Services Examination (Non - Interview Posts)

Applications are invited only through online mode for direct recruitment to the posts in Combined Technical Services Examination (Non - Interview Posts).

### 1. Important Instructions:

#### 1.1. Candidates to ensure their eligibility for the examination:

All candidates are requested to carefully read the "Instructions to Applicants" available in the Commission's website [www.tnpsc.gov.in](http://www.tnpsc.gov.in) and this Notification. The candidates applying for the examination should ensure that they fulfill all eligibility conditions for admission to the examination. **Their admission to all stages of the examination will be purely provisional, subject to their satisfying the eligibility conditions.** Mere admission to the written examination, certificate verification, counselling or inclusion of name in the selection list will not confer on the candidates any right to appointment. The Commission reserves the right to reject candidature at any stage, after due process even after selection has been made, if a wrong claim or violation of rules or instructions is confirmed.

#### 1.2. Important Dates and Time:

Date of Notification	20.05.2026	
Date of commencement of receiving application	27.05.2026	
Last date and time for submission of online application	25.06.2026 11:59 PM	
Application Correction Window period	29.06.2026 12:01 AM to 01.07.2026 11:59 PM	
<b>Date and Time of Examination</b>		
<b>Paper - I</b>		
<b>Subject</b>	<b>Subject Code</b>	<b>Date</b>
Tamil Eligibility Test, General Studies, Aptitude and Mental Ability	503	Will be announced later
<b>Paper - II</b>		
<b>Subject Paper</b>	<b>Subject Code</b>	
Agricultural, Mechanical, Automobile and Civil Engineering	562	
Agriculture	491	
Agriculture, Chemistry, Zoology and Botany	518	
Archaeology	420	
Archaeology, Epigraphy, Heritage Management and Museology	421	
Architecture	401	
Basics of Engineering	422	
Business Administration	385	
Chemistry (Degree)	430	
Civil Engineering	398	

Computer Science, Information Technology, Electrical, Electronics and Communication Engineering	554	Will be announced later
Criminology, Forensic Science, Psychology and Philosophy	571	
Dairy Science, Dairy Technology, Food Technology, Food Processing	579	
Electrical, Electronics and Communication Engineering	514	
Environmental and Chemical Engineering	393	
Environmental Science, Biology and Chemistry	557	
Evaluation and Applied Research	607	
Financial and Cost Accountancy (Intermediate)	433	
Geology	395	
Horticulture	493	
Industrial Safety and Health	515	
Library and Information Science	594	
Mechanical Production and Manufacturing Engineering	399	
Pharmacy, Clinical Pharmacology and Micro Biology	516	
Physics, Chemistry, Biology, Computer Science and Forensic Science	575	
Statistics and Mathematics (PG Degree)	506	
Statistics, Mathematics and Economics	504	
Town Planning, Civil Engineering and Architecture	560	
Translation	462	
Travel and Tourism	597	
Visual Communication	477	

1.2.1. The paper wise date and time for the examination will be informed only through Commission's website [www.tnpsc.gov.in](http://www.tnpsc.gov.in)

### 1.3. How to Apply:

#### 1.3.1. One Time Registration and Online Application:

Candidates are required to apply online by using the Commission's website [www.tnpscexams.in](http://www.tnpscexams.in). The candidate needs to register himself / herself first at the One Time Registration (OTR) platform, available on the Commission's website, and then proceed to fill up the online application for the examination. If the candidate is already registered, he / she can proceed straightway to fill up the online application for the examination.

#### 1.3.2. Application Correction Window:

After the last date for submission of online application, the Application Correction Window will open for 3 days from 29.06.2026 to 01.07.2026. During this period, candidates will be able to edit the details in their online application. After the last date of the Application Correction Window period, no modification is allowed in the online application.

#### 1.3.3. Subject Paper Options:

Candidates should choose the subject paper(s) and specify in the online application. The candidates should only choose the subject paper(s) in which they have obtained the educational qualification or equivalent qualification for appearing in the examination.

1.3.4. The detailed instructions regarding how to apply and the examination centers are available in Annexure I of this Notification.

1.3.5. Any claim by the candidate after the submission of an online application will not be entertained.

**1.4. Banned Items:**

1.4.1. Candidates are not allowed to bring mobile phone, pager or any electronic equipment or programmable device or storage media like pen drive, smart watches, watches with in-built memory notes, rings with in-built memory notes, etc., or camera or Bluetooth devices or communication chips or any other equipment or related accessories either in working or switched off mode capable of being used as a communication device into the examination hall / room. Candidates are not allowed to bring non-electronic devices such as P&G Design Data Book, mathematical and drawing instruments, log tables, stencils of maps, slide rules, books, notes, loose sheets, guides, rough sheets, hand bags into the examination hall / room.

1.4.2. If they are found to have any such things or instruments, they will not be allowed to write the examination, besides invalidation of the answer sheet / answer booklets and / or debarment and / or rejection of candidature. If it is considered necessary, they will be subjected to a thorough physical search including frisking on the spot.

1.4.3. Candidates are advised, in their own interest, not to bring any of the banned items including mobile phones to the venue of the examination, as arrangements for safekeeping of the same cannot be assured.

**2. Warning:**

2.1. All the recruitments by the Tamil Nadu Public Service Commission are purely merit-based. The Tamil Nadu Public Service Commission hereby cautions the candidates against touts and agents who may cheat, by making false promises of securing jobs through unfair means. The Tamil Nadu Public Service Commission shall not be responsible or liable for any loss that may be caused to any candidate on account of indulging in any sort of dealings with such unscrupulous elements.

2.2. Candidates are solely responsible for their claims in the online application. They cannot blame service providers like internet cafes / browsing centers / common service centers for the mistakes made while applying online for recruitment. Candidates are advised to check the filled-in online application before finally submitting the same.

**3. Posts and Vacancies:**

S. No.	Name of the Post	Post Code	Name of the Department / Organization	Number of Vacancies	Level of Pay
1.	Assistant Geologist	1863	Geology and Mining	8	Level 20
2.	Assistant Geologist	1677	Agricultural Engineering	2	
3.	Assistant Engineer (Agricultural Engineering)	1667		64	
4.	Agriculture Officer (Extension)	1678	Agriculture	11	
5.	Drug Inspector	1972	Drug Control Administration	9*	
6.	Horticultural Officer	3001	Horticulture	17*#	
7.	Assistant Engineer	1661	Highways	38	
8.	Assistant Director (Industrial Safety and Health)	1664	Industrial Safety and Health	3	
9.	Junior Assistant Director of Boilers	3008	Public Works	2	
10.	Junior Architect	1860		5*	
11.	Assistant Engineer (Civil)	3656		14	
12.	Assistant Engineer (Electrical)	1657		13	

13.	Assistant Engineer	1660	Rural Development and Panchayat Raj	50	Level 20	
14.	Assistant Engineer (Civil)	1656	Water Resources	33		
15.	Assistant Geologist	1750		9		
16.	Assistant Engineer (Civil)	3230	Tamil Nadu Urban Habitat Development Board	1**		
17.	Assistant Engineer	3269	Tamil Nadu Pollution Control Board	1		
18.	Environmental Scientist	3606		4		
19.	Architectural Assistant / Planning Assistant	2108	Town and Country Planning	3		
20.	Assistant Engineer (Industries)	1900	Industries and Commerce	1 <sup>s</sup>	Level 20 (EPF)	
21.	Assistant Manager (IT)	3810	Electronics Corporation of Tamil Nadu Limited	4		
22.	Assistant Manager (Civil)	3811		2		
23.	Assistant Manager (Electrical)	3812		2		
24.	Assistant Accounts Officer	3814	Tamil Nadu Medical Services Corporation Limited	1	Level 19 (EPF)	
25.	Archaeological Officer	1843	Archaeology	10	Level 18	
26.	Research Assistant	1861	Evaluation and Applied Research	2		
27.	Junior Scientific Officer	1767	Forensic Science	6		
			Group	No. of vacancies		
			Chemistry	4		
			Biology	2		
28.	Assistant Superintendent of Approved Schools (Men & Women)	2078	Child Welfare and Special Services	Men 1 Women 1	2	Level 17
29.	Assistant Engineer (Civil)	3368	State Industries Promotion Corporation of Tamil Nadu	2	Level 17 (GFTR, PFTR, SPF cum GSTR)	
30.	System Manager	3664	Civil Supplies and Consumer Protection	1	Level 16	
31.	Translator	3106	Law	2		
32.	Librarian	1845	Agriculture	1	Level 15	
33.	Statistical Assistant	3125	Food Safety and Drug Administration	1	Level 13	
34.	Deputy Manager (Dairying)	3279	Tamil Nadu Co-operative Milk Producers' Federation Limited	2**	Level 13 (EPF)	
35.	Assistant Engineer (Mechanical)	3611	Tamil Nadu Magnesites Limited	3	Level 12 (EPF)	
36.	Assistant Archaeological Officer	1842	Archaeology	10	Level 11	
37.	Assistant Tourist Officer, Grade II	3111	Tourism	4	Level 10	
38.	Assistant Statistical Investigator	1824	Economics and Statistics	13		
39.	Block Health Statistician	2010	Family Welfare	62* <sup>@</sup>		
40.	Junior Photographer	3805	Tamil Development and Information	23	Level 09	
41.	Assistant Librarian	2013	Legal Studies	5	Level 08	

42.	Assistant Warehouse Manager / Junior Assistant	3388	Tamil Nadu Warehousing Corporation Limited	1 <sup>\$</sup>	Level 08 (EPF)
43.	Junior Chemist	3609	Tamil Nadu Magnesites Limited	3	
44.	Assistant Engineer (Mechanical)	3268	Tamil Nadu Power Distribution Corporation Limited	1 <sup>**</sup>	Level 1 <sup>\$\$</sup> (Rs.39800-126500)
45.	Assistant General Manager / Regional Manager	3798	Tamil Nadu Handloom Weavers Co-operative Society Limited	10 <sup>^#</sup>	Rs.28480-90570 <sup>\$\$</sup> (EPF)
<b>Total</b>				<b>461</b>	

- \* Including backlog vacancies.  
\*\* Only backlog vacancies.  
@ Vacancies for reservation for outstanding sports persons, are deducted wherever applicable.  
\$ Only shortfall vacancy.  
# Including shortfall vacancies.  
^ The selected candidates for the post of Assistant General Manager / Regional Manager (Post code: 3798) should be ready to be posted anywhere in India.  
\$\$ The rule of reservation of appointment to Ex-servicemen and Destitute Widow will not apply for the posts of Assistant Engineer (Mechanical) (Post Code.3268). in Tamil Nadu Power Distribution Corporation Limited and Assistant General Manager / Regional Manager (Post Code.3798) in Tamil Nadu Handloom Weavers Co-operative Society Limited

**Abbreviations:**

- EPF – Employees' Provident Fund  
GFTR – Gratuity Fund Trust Rules  
PFTR – Provident Fund Trust Rules  
SPF cum GSTR – PF-cum-Gratuity Scheme Trust Rules.

3.1. The number of vacancies and distribution of vacancies are tentative and is liable for modification, before the commencement of physical certificate verification / counselling. Whenever the vacancies are revised, the number of candidates selected for the successive stages will also be revised commensurately.

3.2. The Commission reserves the right to include additional posts with different nomenclature and having similar eligibility conditions, as announced in this notification.

3.3. The post wise distribution of vacancies is available in the Annexure VI of this Notification.

**4. Eligibility Conditions:**

**4.1. Age Limit: (as on 01.07.2026)**

The candidates should have completed the age of 21 years for all the posts. The category wise maximum age limit and age concession details are given below:

**4.1.1. Others (Candidates not belonging to SCs, SC(A)s, STs, MBCs/DCs, BC(OBCM)s and BCMs):**

S. No.	Name of the Post	Post Code	Maximum Age (Should not have completed)	Age Concession			
				Persons with Benchmark Disability	Ex-Servicemen	Destitute Widow	
1.	Assistant Engineer (Mechanical)	3268	32	42		37	
2.	Assistant General Manager / Regional Manager	3798				34	
3.	Assistant Engineer	3269					
4.	Environmental Scientist	3606					
5.	Junior Photographer	3805	42	52	No Maximum Age Limit		
6.	Agriculture Officer (Extension)	1678	32*	42**			
7.	Horticultural Officer	3001	32 <sup>#</sup>				
8.	Assistant Geologist	1677	32	42		50	
9.	Assistant Engineer (Agricultural Engineering)	1667					
10.	Architectural Assistant / Planning Assistant	2108					
11.	Archaeological Officer	1843					
12.	Assistant Archaeological Officer	1842					
13.	Assistant Statistical Investigator	1824					
14.	Drug Inspector	1972					
15.	Research Assistant	1861					
16.	Block Health Statistician	2010					
17.	Assistant Geologist	1863					
18.	Assistant Engineer	1660					
19.	Assistant Engineer	1661					
20.	Junior Architect	1860					
21.	Assistant Engineer (Civil)	3656					
22.	Assistant Engineer (Electrical)	1657					
23.	Assistant Engineer (Civil)	1656					
24.	Assistant Engineer (Civil)	3230					
25.	Assistant Warehouse Manager / Junior Assistant	3388					
26.	Deputy Manager (Dairying)	3279					
27.	Assistant Manager (IT)	3810					
28.	Assistant Manager (Civil)	3811					
29.	Assistant Manager (Electrical)	3812					
30.	Assistant Librarian	2013					
31.	Librarian	1845					
32.	Translator	3106					
33.	Junior Assistant Director of Boilers	3008					
34.	Assistant Superintendent of Approved Schools (Men & Women)	2078					
35.	Statistical Assistant	3125					
36.	Assistant Director (Industrial Safety and Health)	1664					
37.	Assistant Engineer (Mechanical)	3611					
38.	Junior Chemist	3609					

39.	Assistant Tourist Officer, Grade II	3111	32	NA	50	No Maximum Age Limit
40.	Junior Scientific Officer	1767				
41.	Assistant Accounts Officer	3814				
42.	Assistant Engineer (Civil)	3368				
43.	Assistant Geologist	1750				
44.	Assistant Engineer (Industries)	1900	37			
45.	System Manager	3664	35			
*	34 years for persons holding a Post Graduate Degree in Agriculture or Ph.D.,					
**	44 years for persons holding a Post Graduate Degree in Agriculture or Ph.D.,					
#	34 years for persons holding a Post Graduate Degree or Ph.D. in Horticulture,					
NA	Not Applicable, since persons with benchmark disability are not eligible to apply for this post.					

#### 4.1.2. SCs, SC(A)s, STs, MBCs/DCs, BC(OBCM)s and BCMs:

S. No.	Name of the Post	Post Code	Maximum Age (Should not have completed)	Age Concession					
				Persons with Benchmark Disability	Ex-Service men	Destitute Widow			
1.	Assistant Engineer	3269	37	47	55	39			
2.	Environmental Scientist	3606							
3.	Assistant Geologist	1677	No Maximum Age Limit						
4.	Assistant Engineer (Agricultural Engineering)	1667							
5.	Agriculture Officer (Extension)	1678							
6.	Archaeological Officer	1843							
7.	Assistant Archaeological Officer	1842							
8.	Drug Inspector	1972							
9.	Research Assistant	1861							
10.	Block Health Statistician	2010							
11.	Assistant Geologist	1863							
12.	Horticultural Officer	3001							
13.	Junior Architect	1860							
14.	Assistant Engineer (Civil)	3656							
15.	Assistant Engineer (Electrical)	1657							
16.	Assistant Engineer (Civil)	3230							
17.	Assistant Warehouse Manager / Junior Assistant	3388							
18.	Deputy Manager (Dairying)	3279							
19.	Architectural Assistant / Planning Assistant	2108							
20.	Assistant Statistical Investigator	1824							
21.	Assistant Engineer	1660							
22.	Assistant Engineer	1661							
23.	Assistant Engineer (Civil)	1656							
24.	Assistant Manager (IT)	3810							
25.	Assistant Manager (Civil)	3811							
26.	Assistant Manager (Electrical)	3812							
27.	Assistant Librarian	2013							
28.	Junior Photographer	3805							
29.	Assistant Accounts Officer	3814					No Maximum Age Limit	NA	No Maximum Age Limit
30.	Librarian	1845							
31.	System Manager	3664							
32.	Assistant Engineer (Industries)	1900							

33.	Translator	3106	No Maximum Age Limit	NA	No Maximum Age Limit					
34.	Junior Assistant Director of Boilers	3008								
35.	Assistant Superintendent of Approved Schools (Men & Women)	2078								
36.	Statistical Assistant	3125								
37.	Assistant Director (Industrial Safety and Health)	1664								
38.	Assistant Engineer (Mechanical)	3611								
39.	Junior Scientific Officer	1767								
40.	Assistant Tourist Officer, Grade II	3111								
41.	Junior Chemist	3609								
42.	Assistant Geologist	1750								
43.	Assistant Engineer (Civil)	3368					BC(OBCM)s, BCMs MBCs/DCs-		50	No Maximum Age Limit
44.	Assistant Engineer (Mechanical)	3268					34, SCs, SC(A)s, STs-37	BC(OBCM)s, BCMs MBCs/DCs-	55	37
45.	Assistant General Manager / Regional Manager	3798						44, SCs, SC(A)s, STs-47		

**Abbreviations:**

BC(OBCM)	- Backward Classes (Other than Backward Class Muslims)
BCM	- Backward Class Muslims
MBC / DC	- Most Backward Classes / Denotified Communities
SC	- Scheduled Castes
SC(A)	- Scheduled Castes (Arunthathiyars)
ST	- Scheduled Tribes
NA	- Not Applicable, since persons with benchmark disability are not eligible to apply for this post.

4.1.3. No maximum age limit shall mean that the candidates should not have completed 60 years of age as on 1.7.2026 or at the time of selection / appointment to the post.

4.1.4. The above mentioned age concession will not apply to the Ex-Servicemen candidates who have already been recruited to any class or service or category, as per section 3 (j) (vii) of Tamil Nadu Government Servants (Conditions of Service) Act, 2016.

**4.1.5. Supporting Documents:**

4.1.5.1. The date of birth will be verified against the tenth standard (SSLC) or twelfth standard (HSC) mark sheet, issued by the Tamil Nadu Board of Secondary Education and Tamil Nadu Board of Higher Secondary Education respectively. Those candidates whose date of birth is not mentioned in their tenth standard / twelfth standard mark sheet must upload their Birth Certificate / Transfer Certificate / Degree marksheet, instead of the tenth standard or twelfth standard mark sheet. Any other form of evidence will not be accepted. Failure to upload such a document shall result in the rejection of candidature after due process.

4.1.5.2. Candidates claiming age concession should upload the supporting documents for such a claim. Failure to upload such a document shall result in the rejection of candidature after due process.

#### 4.2. Educational Qualification and Technical Qualification:

S. No.	Name of the Post	Post Code	Qualification
1.	Assistant Geologist	1750	Master of Science degree in Geology or Master of Science degree in Applied Geology or Master of Science (Technology) in Hydrogeology of any University recognized by the University Grants Commission
2.	Assistant Geologist	1677	A degree in M.Sc., (Geology)
3.	Assistant Geologist	1863	Must possess M.Sc., Degree in Geology / Applied Geology from any University recognized by the University Grants Commission
4.	Assistant Engineer (Agricultural Engineering)	1667	(i) B.E. (Agriculture) (or) B. Tech. (Agricultural Engineering) (or) B.Sc. (Agricultural Engineering) (OR) (ii) B.E. (Mechanical) (or) B.E. (Civil) (or) B.Tech. (Automobile Engineering) or B.E. (Production Engineering) or B.E.(Industrial Engineering) (or) B.E. (Civil and Structural Engineering) (or) B.E (Mechanical and Production Engineering) (iii) Candidates possessing the qualification in item (ii) shall be considered only if no candidate with qualification on item (i) is available
5.	Agriculture Officer (Extension)	1678	(i) A Bachelor degree in Agriculture and, (ii) Must possess adequate knowledge of Tamil
6.	Librarian	1845	(i) Must possess a degree and (ii) Must possess B.Lib Science Degree Provided that other things being equal, preference shall be given to a candidate who has a. Adequate knowledge of French/German b. Previous experience as Librarian in a Library of a college affiliated to a University or a Research Institute or a well established District Library
7.	Assistant Librarian	2013	(i) A Bachelor's degree of a University recognized by the University Grants Commission. (ii) A Bachelor's Degree in Library Science or Library and Information Science of a University recognized by the University Grants Commission.
8.	Archaeological Officer	1843	(i) Must possess Post Graduate degree in Ancient History and Archaeology / Archaeology / History and Archaeology / Epigraphy and Archaeology / History, Archaeology and Manuscriptology awarded by a University recognized by the University Grants Commission; (OR) (ii) (1) Must possess any Post Graduate degree awarded by a University recognized by the University Grants Commission; and (2)(a) Must possess one year Post Graduate diploma in Epigraphy and Archaeology awarded by the Tamil Nadu Institute of Epigraphy, Department of Archaeology; (OR) (b) Two years Post Graduate diploma in Archaeology / Epigraphy/ Heritage Management and Museology awarded by the Tamil Nadu Institute of Archaeology and Museology, Department of Archaeology;

			<p>(OR)</p> <p>(c) Post Graduate diploma in Archaeology awarded by the Archaeological Survey of India; and</p> <p>(iii) Must have passed Tamil as one of the subject in degree level.</p> <p>"Provided that the candidates who have obtained a degree in B.E., (Civil Engineering), a post graduate degree in M.E / M.Tech., must have passed Tamil as one of the subjects in S.S.L.C., Level."</p>
9.	Assistant Archaeological Officer	1842	<p>(i) Must possess any Post Graduate degree awarded by a university recognized by the University Grants Commission including Post Graduate degree awarded by the Tamil University, Thanjavur, and</p> <p>(ii) (a) Must possess one year Post Graduate diploma in Epigraphy and Archaeology awarded by the Tamil Nadu Institute of Epigraphy, Department of Archaeology</p> <p>(OR)</p> <p>(b) Two years Post Graduate diploma in Archaeology / Epigraphy / Heritage Management and Museology awarded by the Tamil Nadu Institute of Archaeology and Museology, Department of Archaeology</p> <p>(iii) Must have passed Tamil as one of the subjects in degree level</p> <p>"Provided that the candidates who have obtained a degree in B.E., (Civil Engineering), a post graduate degree in M.E or M.Tech., must have passed Tamil as one of the subjects in S.S.L.C., Level."</p>
10.	System Manager	3664	<p>(i) A Bachelor's Degree in Engineering (B.E.,) or Bachelor's degree in Technology (B.Tech) with Computer Science and Engineering or Computer Engineering or Information Technology or Electronics and Communication Engineering or Electrical and Electronics Engineering as main subject or a Post Graduate degree in Computer Applications (MCA) or Computer Science or Information Technology as main subject from any University or Institution recognized:</p> <p>(ii) Candidates with Master Degree in Computer Application should have a Bachelor's Degree in Science or Mathematics from any recognized University; and</p> <p>(iii) Must have studied Under Graduate/Post Graduate Degree, as the case may be, after completion of SSLC and Higher Secondary Course</p>
11.	Assistant Manager (IT)	3810	<p>(i) Must have a B.E., or B.Tech., degree with overall first class or equivalent Cumulative Grade Point Average (CGPA) in any of the following subjects:</p> <p>(a) Computer Science and Engineering</p> <p>(b) Computer Engineering</p> <p>(c) Information Technology</p> <p>(d) Electronics and Communication Engineering</p> <p>(e) Electrical and Electronics Engineering</p> <p>(B.E., or B.Tech in Artificial Intelligence (AI), Machine Learning (ML), Data Science, Cloud Computing / Cloud Engineering will be treated as equivalent to the above courses)</p> <p>(ii) Must have an overall first class or equivalent Cumulative Grade Point Average (CGPA) in:</p>

			(a) Secondary School Leaving Certificate (SSLC) (Class 10) or equivalent (b) Higher Secondary Certificate (HSC) (class 12) or Senior Secondary Certificate (SSC) or equivalent
12.	Drug Inspector	1972	Must possess a degree in Pharmacy or Pharmaceutical Sciences or Medicine with specialization in Clinical Pharmacology or Microbiology from a University or Institution recognized by the University Grants Commission for the purpose of its grant
13.	Research Assistant	1861	Must possess a first class Post-Graduate degree in Economics or Econometrics or Statistics or Business Administration or Mathematics or Social work or Sociology or Anthropology or Agricultural Economics or Public Administration
14.	Block Health Statistician	2010	A degree in Statistics or Mathematics or Economics from any University or Institution, recognized by the University Grants Commission
15.	Assistant Statistical Investigator	1824	Must hold a Degree in Statistics or Mathematics or Economics or Applied Economics or Business Economics
16.	Horticultural Officer	3001	Must possess B.Sc., Horticulture.
17.	Assistant Engineer (Industries)	1900	Must possess a Bachelor of Engineering or Bachelor of Technology degree of any discipline except Civil Engineering and Architectural Engineering of any University recognized by the University Grants Commission or Institution recognized by the All India Council for Technical Education
18.	Junior Architect	1860	Must possess a degree in Architecture of any University or Institution recognized by the University Grants Commission and should be a registered member of the Council of Architecture
19.	Translator	3106	(i) Must possess a degree in Law awarded by any University or Institution recognized by the University Grants Commission and recognized by the Bar Council of India for the purpose of enrolment as an Advocate and (ii) Proficiency in Tamil (iii) Other things being equal, preference shall be given to the persons with previous experience in translation of Deeds, Agreements, Bill, Acts, Rules or Orders from English to Tamil
20.	Junior Assistant Director of Boilers	3008	Must possess a Degree in Mechanical Engineering or a pass in Associate Membership Examination of the Institution of Engineers, India with Mechanical Engineering as the subject
21.	Assistant Engineer (Civil)	3656	(i) Must possess the B.E degree in Civil Engineering or Civil and Structural Engineering; or Must have passed in Sections A and B of the Institution Examinations under Civil Engineering Branch (ii) Other things being equal, preference shall be given to those who have undergone one year of apprenticeship training under the Government of India scheme or the State Government Apprenticeship scheme (iii) Other things being equal, preference shall be given to released Emergency commissioned officers, released short service commissioned officers or other Ex-servicemen released from the Armed Forces
22.	Assistant Engineer (Civil)	3368	Must possess B.E/B.Tech Degree in Civil Engineering from a recognized University / Institution

23.	Assistant Engineer (Civil)	3230	<p>Must possess a degree in Engineering (Civil) of any University recognized by the State Government or any other equivalent qualification</p> <p>(OR)</p> <p>Must have passed section A and B of A.M.I.E (India) Examination with the following;</p> <p>(i) A Pass in H.Sc. Examination</p> <p>(ii) Must have passed Geology under Section B as an optional or additional subject</p>
24.	Assistant Engineer	1660	<p>(i) Must possess a B.E degree in Civil Engineering</p> <p>(OR)</p> <p>Must have passed Sections A and B of the Institution of Engineers (India) in Civil Engineering Branch, and he should furnish evidence of having undergone practical training in surveying for a period of not less than one year</p> <p>(ii) Other things being equal preference shall be given for appointment to a person who has undergone one year of apprenticeship under the Government of India Scheme or the State Government Apprenticeship Scheme</p>
25.	Assistant Engineer	1661	<p>(i) Must possess a degree in Civil Engineering from a University recognized by the University Grants Commission</p>
26.	Assistant Engineer (Civil)	1656	<p>(i) Must possess the B.E degree in Civil Engineering or Civil and Structural Engineering;</p> <p>(OR)</p> <p>Must have passed in Sections A and B of the Institution Examinations under Civil Engineering Branch</p> <p>(ii) Other things being equal, preference shall be given to those who have undergone one year of apprenticeship training under the Government of India scheme or the State Government Apprenticeship Scheme</p> <p>(iii) Other things being equal, preference shall be given to released Emergency Commissioned Officers, released short service Commissioned Officers or other Ex-servicemen released from the Armed Forces</p>
27.	Assistant Manager (Civil)	3811	<p>(i) Must have a B.E., or B.Tech., degree with overall first class or equivalent Cumulative Grade Point Average (CGPA) in Civil Engineering or Civil and Structural Engineering</p> <p>(ii) Must have an overall first class or equivalent Cumulative Grade Point Average (CGPA) in:</p> <p>(a) Secondary School Leaving Certificate (SSLC) (Class 10) or equivalent</p> <p>(b) Higher Secondary Certificate (HSC) (class 12) or Senior Secondary Certificate (SSC) or equivalent</p>
28.	Assistant Manager (Electrical)	3812	<p>(i) Must have a B.E., or B.Tech., degree with overall first class or equivalent Cumulative Grade Point Average (CGPA) in Electrical Engineering or Electronics and Communication Engineering or Electrical and Electronics Engineering</p> <p>(ii) Must have an overall first class or equivalent Cumulative Grade Point Average (CGPA) in:</p> <p>(a) Secondary School Leaving Certificate (SSLC) (Class 10) or equivalent</p> <p>(b) Higher Secondary Certificate (HSC) (class 12) or Senior Secondary Certificate (SSC) or equivalent</p>

29.	Assistant Engineer (Electrical)	1657	(i) Must possess a degree in Electrical Engineering or Electronics and Communication Engineering; (OR) A pass in Sections A and B of the Institution Examinations with Electrical Engineering as a subject (ii) Other things being equal, preference shall be given to those who have undergone one year Apprenticeship training under the Government of India scheme or one year training under the Government of Tamil Nadu Special Apprenticeship Training Scheme
30.	Assistant Engineer (Mechanical)	3611	B.E., Mechanical Engineering
31.	Assistant Engineer (Mechanical)	3268	(i) A Degree in Mechanical Engineering or equivalent. (ii) Other things being equal, preference will be given to the candidates who have completed the apprenticeship training in erstwhile Tamil Nadu Electricity Board / Tamil Nadu Generation and Distribution Corporation / Tamil Nadu Transmission Corporation Limited.
32.	Assistant Warehouse Manager / Junior Assistant	3388	A degree in Agriculture or in Science of any recognized University with Chemistry, Botany or Zoology as a major or Ancillary subject
33.	Deputy Manager (Dairying)	3279	Must possess Degree with IDD / NDD or Post Graduate Degree in Dairy Science or B.Tech in Food Technology/ Dairy Technology/ Food Processing from any approved institutions
34.	Architectural Assistant / Planning Assistant	2108	Must possess a Degree of Master of Town Planning or its equivalent; (OR) Associate Membership of the Institute of Town Planners of India or Institute of Architects of India; (OR) A Degree in Civil Engineering; (OR) A Degree in Architecture; (OR) An A.M.I.E (Civil) (i.e.,) Associate Member of the Institution of Engineers (India)
35.	Assistant General Manager / Regional Manager	3798	Any UG Degree with MBA in Marketing/Finance/Human Resource
36.	Junior Photographer	3805	A pass in B.SC degree in Visual Communication
37.	Assistant Superintendent of Approved Schools (Men & Women)	2078	(i) A Master's degree in Criminology or Forensic Science; (OR) (ii) B.A. degree in Psychology or in Philosophy with Psychology as one of the subjects of study (iii) Other things being equal, preference shall be given to candidates who have had training in correctional work in any School of Social Work or Experience in the education of children or experience in management of Children's Homes especially of Juvenile delinquents
38.	Statistical Assistant	3125	A Master degree in Mathematics or Statistics with working knowledge of computer statistical tools
39.	Assistant Director (Industrial Safety and Health)	1664	A Degree in Mechanical or Electrical or Chemical Engineering or Textile Technology or Industrial Engineering or Production Engineering

40.	Junior Chemist	3609	B.Sc. (Chemistry)																																			
41.	Assistant Engineer	3269	Master's Degree in Environmental Engineering or Chemical Engineering or M.Tech. Environmental Science and Technology or M.Tech. Petroleum Refining and Petrochemical or M.E. Environmental Management awarded by Anna University with a basic qualification of Bachelor's Degree in Civil Engineering or Chemical Engineering or Environmental Engineering																																			
42.	Environmental Scientist	3606	Master's Degree in Science in any one of the following discipline a. Chemistry b. Biology c. Zoology d. Environmental Chemistry e. Environmental Science f. Environmental Toxicology g. Microbiology h. Marine Biology i. Bio-Chemistry j. Analytical Chemistry k. Applied Chemistry l. Botany																																			
43.	Assistant Tourist Officer, Grade II	3111	(i) Degree in Travel and Tourism or any Degree with Diploma in Tourism (ii) Certificate Course in Computer on Office Automation awarded by the Directorate of Technical Education, Government of Tamil Nadu or its equivalent; and (iii) Proficiency in English and Tamil Languages i.e. must have studied both Tamil and English as one of the subjects at SSLC or HSC level																																			
44.	Junior Scientific Officer	1767	(i) M.Sc. (Forensic Science) degree and a degree in the subject, for the group as shown in the explanation below to which he/she is appointed (OR) M.Sc. degree in the subject for the group as shown in the explanation below to which he/she is appointed. (ii) Other things being equal, preference shall be given to person who holds a degree in M.Sc. (Forensic Science). Explanation: The group, Division and subjects are specified below:-																																			
			<table border="1"> <thead> <tr> <th>Sl. No.</th> <th>Name of the Group (2)</th> <th>Division/Unit belonging to the Group (3)</th> <th>Subject eligible for Division/Unit (4)</th> </tr> </thead> <tbody> <tr> <td rowspan="4">1</td> <td rowspan="4">Biology</td> <td>i</td> <td>Anthropology</td> <td>Zoology / Physical Anthropology</td> </tr> <tr> <td>ii</td> <td>Biology</td> <td>Botany / Zoology / Bio-Chemistry / Micro-Biology / Bio-Technology / Genetics</td> </tr> <tr> <td>iii</td> <td>Serology</td> <td></td> </tr> <tr> <td>iv</td> <td>DNA</td> <td></td> </tr> <tr> <td rowspan="5">2</td> <td rowspan="5">Chemistry</td> <td>i</td> <td>Chemistry</td> <td>Chemistry (Organic / Inorganic / Physical / Analytical / Polymer / Applied)/ Environmental Toxicology</td> </tr> <tr> <td>ii</td> <td>Explosives</td> <td></td> </tr> <tr> <td>iii</td> <td>Narcotics</td> <td></td> </tr> <tr> <td>iv</td> <td>Toxicology</td> <td>Chemistry (Organic / Inorganic / Physical /</td> </tr> <tr> <td>v</td> <td>Prohibition</td> <td></td> </tr> </tbody> </table>	Sl. No.	Name of the Group (2)	Division/Unit belonging to the Group (3)	Subject eligible for Division/Unit (4)	1	Biology	i	Anthropology	Zoology / Physical Anthropology	ii	Biology	Botany / Zoology / Bio-Chemistry / Micro-Biology / Bio-Technology / Genetics	iii	Serology		iv	DNA		2	Chemistry	i	Chemistry	Chemistry (Organic / Inorganic / Physical / Analytical / Polymer / Applied)/ Environmental Toxicology	ii	Explosives		iii	Narcotics		iv	Toxicology	Chemistry (Organic / Inorganic / Physical /	v	Prohibition	
Sl. No.	Name of the Group (2)	Division/Unit belonging to the Group (3)	Subject eligible for Division/Unit (4)																																			
1	Biology	i	Anthropology	Zoology / Physical Anthropology																																		
		ii	Biology	Botany / Zoology / Bio-Chemistry / Micro-Biology / Bio-Technology / Genetics																																		
		iii	Serology																																			
		iv	DNA																																			
2	Chemistry	i	Chemistry	Chemistry (Organic / Inorganic / Physical / Analytical / Polymer / Applied)/ Environmental Toxicology																																		
		ii	Explosives																																			
		iii	Narcotics																																			
		iv	Toxicology	Chemistry (Organic / Inorganic / Physical /																																		
		v	Prohibition																																			

				vi	Excise	Analytical / Polymer / Applied) / Bio-Chemistry / Environmental Toxicology	
			3	Physics	Physics	Physics	
			4	Physics and Chemistry	i	Ballistics	Physics / Chemistry (Organic / Inorganic / Physical / Analytical / Polymer / Applied)
					ii	Computer Forensic Science	Chemistry / Computer Science / Physics
			<p>Note:</p> <p>The individuals who possess M.Sc. degree in Computer Science must have acquired a basic degree in Physics or Chemistry as major subject</p> <p>The individuals who possess M.Sc. degree in Environmental Toxicology must have acquired a basic degree with Chemistry as major subject, for appointment in Chemistry or Prohibition or Excise or Explosives or Narcotics Divisions/Units</p> <p>The individuals who possess M.Sc. degree in Physics or Chemistry or Forensic Science with a basic degree in Physics or Chemistry as major subject must have acquired a Diploma or Post-graduate Diploma in Computer Application or any subject related to Computer Science for appointment in Computer Forensic Science Division/Unit.</p>				
45.	Assistant Accounts Officer	3814	<p>(i) A Degree of any University or Institution recognized by UGC for the purpose of its grant. and</p> <p>(ii) Must have passed an Intermediate Examination conducted by the Institute of Chartered Accountants of India/Institute of Cost Accounts of India.</p>				

4.2.1. The candidates should possess the educational qualification and technical qualification prescribed for the post, on the date of notification.

4.2.2. The Under Graduate / Post Graduate degree / Ph.D Degree certificate qualification prescribed for the above posts should have been obtained by passing the required qualification in the following order of studies viz., SSLC + HSC / Diploma or its equivalent + Under Graduate Degree + Post Graduate Degree + Ph.D Degree.

#### 4.2.3. Supporting Documents:

4.2.3.1. SSLC / HSC / Diploma / Degree / PG Degree / Integrated PG Degree / Ph.D Degree / Provisional Degree or Provisional Diploma Certificate / Consolidated Mark Sheet along with Degree or Provisional Degree Certificate shall be accepted as proof of educational qualification.

4.2.3.2. In cases where the Diploma / Degree / PG Degree / Ph.D Degree certificates not yet been issued before the date of notification, candidates must upload proof of the publication of results of the respective qualification(s) on or before the date of notification in the form of Provisional Diploma / Degree Certificate / Consolidated Mark Sheet / Certificate from the Head of the Institution / University in the format prescribed in Annexure V.

4.2.3.3. Candidates claiming possession of qualification higher than that prescribed for a post, must upload certificates, issued on / before the date of notification, in support of such claim.

4.2.3.4. In cases where the duration of the prescribed educational / technical course has been specified in the notification, any discrepancy between the claim in the application and the documents uploaded shall result in the rejection of candidature after due process.

4.2.3.5. In case the Degree Certificate is lost or is not immediately available for reasons to be specified, an extract from the Convocation Register will be accepted as evidence of qualification.

4.2.3.6. The candidates claiming equivalence of qualification should upload a copy of the Government order or submit it as and when called for, failing which his / her candidature will be rejected after due process. The Government orders relating to equivalence of qualification are available on the website of the Tamil Nadu State Council for Higher Education ([www.tnsche.tn.gov.in](http://www.tnsche.tn.gov.in)).

### 4.3. Medical and Physical Standards:

4.3.1. Candidates selected for appointment to the posts will be required to submit a certificate of physical fitness to the Appointing Authority at the time of joining the post.

4.3.2. The prescribed standards of visual acuity of the candidates selected for the following posts are mentioned below;

S. No.	Name of the Post	Post Code	Standard of Vision
1.	Junior Scientific Officer	1767	Standard I or better. Colour blindness will be a disqualification
2.	Assistant Engineer (Mechanical)	3268	Standard - III or better. Colour vision defective and Night blindness will be a disqualification
3.	Assistant Manager (IT)	3810	
4.	Assistant Manager (Civil)	3811	
5.	Assistant Manager (Electrical)	3812	
6.	Agriculture Officer (Extension)	1678	Standard III or better. Colour blindness will be a disqualification
7.	Drug Inspector	1972	
8.	Research Assistant	1861	
9.	Horticultural Officer	3001	
10.	Junior Architect	1860	
11.	Assistant Geologist	1750	
12.	Assistant Superintendent of Approved Schools (Men & Women)	2078	Standard I or better
13.	Assistant Engineer (Agricultural Engineering)	1667	Standard II
14.	Assistant Archaeological Officer	1842	Standard II or better
15.	Architectural Assistant / Planning Assistant	2108	
16.	Assistant Engineer	1661	
17.	Assistant Director (Industrial Safety and Health)	1664	
18.	Assistant Engineer	1660	Standard III or better
19.	Librarian	1845	
20.	Archaeological Officer	1843	
21.	System Manager	3664	
22.	Assistant Geologist	1677	
23.	Block Health Statistician	2010	
24.	Assistant Geologist	1863	
25.	Assistant Engineer (Industries)	1900	
26.	Translator	3106	
27.	Assistant Engineer (Civil)	3656	
28.	Assistant Engineer (Electrical)	1657	
29.	Assistant Engineer (Civil)	3368	
30.	Assistant Engineer (Civil)	3230	
31.	Assistant Warehouse Manager / Junior Assistant	3388	

32.	Deputy Manager (Dairying)	3279	Standard III or better
33.	Assistant General Manager / Regional Manager	3798	
34.	Assistant Statistical Investigator	1824	
35.	Statistical Assistant	3125	
36.	Assistant Engineer (Civil)	1656	
37.	Assistant Engineer	3269	
38.	Environmental Scientist	3606	
39.	Assistant Engineer (Mechanical)	3611	
40.	Junior Chemist	3609	
41.	Assistant Accounts Officer	3814	
42.	Assistant Tourist Officer, Grade II	3111	
43.	Junior Photographer	3805	
44.	Assistant Librarian	2013	
45.	Junior Assistant Director of Boilers	3008	

4.3.3. Candidates with defective vision should submit an Eye Fitness certificate from a qualified Eye Specialist working in a Government Hospital at the time of joining the post, to the Appointing Authority.

4.3.4. Candidates who have applied for the posts of Junior Scientific Officer (Post Code.1767), Assistant Engineer (Mechanical) (Post Code.3268), Assistant Manager (IT) (Post Code.3810), Assistant Manager (Civil) (Code.3811), Assistant Manager (Electrical) (Post Code.3812), Agricultural Officer (Extension) (Post Code-1678), Drug Inspector (Post Code-1972), Research Assistant (Post Code-1861), Horticultural Officer (Post Code-3001), Junior Architect (Post Code-1860) and Assistant Geologist (Post Code.1750) should upload the eye fitness certificate obtained from the specialist in Ophthalmology working in the Government Hospital in the format prescribed in Annexure V at the time of submission of online application. Failing which his/her application will not be considered for the said posts.

#### **4.4. Knowledge in Tamil:**

4.4.1. Candidates should possess adequate knowledge in Tamil on the date of this Notification. The candidate shall be deemed to possess an adequate knowledge of Tamil if, he/she has passed the SSLC examination or its equivalent examination / HSC / Degree, etc., with Tamil as one of the languages or studied the High School Course in Tamil medium; or passed the SSLC examination or its equivalent examination in Tamil medium; or passed the Second Class Language Test (Full Test) in Tamil conducted by the Tamil Nadu Public Service Commission.

4.4.2. Candidates must upload either SSLC / HSC / Degree / PG Degree mark sheets or proof of having passed the Second Class Language Test (Full Test) in Tamil conducted by the Tamil Nadu Public Service Commission, at the time of submission of online application.

4.4.3. Failure to produce documents in support of the possession of adequate knowledge of Tamil, shall result in the candidate being required to pass the Second Class Language Test (Full Test) in Tamil conducted by the Commission, within a period of two years from the date of his / her appointment, failing which he / she shall be discharged from service. This instruction is not applicable to the post of Agricultural Officer (Extension) (Post Code-1678), Assistant Tourist Officer, Grade II (Post Code-3111), Assistant Archaeological Officer (Post Code.1842), Translator (Post Code.3106) and Archaeological Officer (Post Code.1843).

#### **4.5. Restrictions on applying for the Examination:**

4.5.1. The candidates not belonging to SCs, SC(A)s, STs, MBCs/DCs, BC(OBCM)s, and BCMs, who have put in 5 years or more of service, since his/ her first appointment to a service of Government of India or Government of a State / Union Territory, are not eligible to apply even if they are within the age limit.

4.5.2. The persons with benchmark disabilities are not eligible for the following posts;

S.No.	Name of the Post	Post Code	Department / Organization
1.	System Manager	3664	Civil Supplies and Consumer Protection
2.	Assistant Engineer (Industries)	1900	Industries and Commerce
3.	Translator	3106	Law
4.	Librarian	1845	Agriculture
5.	Junior Assistant Director of Boilers	3008	Public Works
6.	Assistant Superintendent of Approved Schools (Men & Women)	2078	Child Welfare and Special Services
7.	Statistical Assistant	3125	Food Safety and Drug Administration
8.	Assistant Director (Industrial Safety and Health)	1664	Industrial Safety and Health
9.	Assistant Engineer (Mechanical)	3611	Tamil Nadu Magnesite Limited
10.	Junior Chemist	3609	Tamil Nadu Magnesite Limited
11.	Assistant Tourist Officer, Grade II	3111	Tourism
12.	Junior Scientific Officer	1767	Forensic Science
13.	Assistant Engineer (Civil)	3368	State Industries Promotion Corporation of Tamil Nadu
14.	Assistant Accounts Officer	3814	Tamil Nadu Medical Services Corporation Limited
15.	Assistant Geologist	1750	Water Resources

#### 4.6. Posts identified suitable for Persons with Benchmark Disability:

4.6.1. The following posts are identified as suitable for reservation to persons with benchmark disabilities as detailed below:

S. No.	Name of the Post	Post Code	Suitable Category of Benchmark Disabilities
1.	Assistant Warehouse Manager / Junior Assistant	3388	LV, HI, HH, LD (OA,OL,OAOL), CP, LC, DF, AC, ASD, SLD, MI, MD of the above
2.	Archaeological Officer	1843	HH, LC, DF, AC, SLD, MD of the above
3.	Junior Photographer	3805	HH, LC, AC (with both hand intact) SLD and MD
4.	Assistant Geologist	1677	LV,HI,HH,LD,LC,DF,AC
5.	Assistant Engineer (Agricultural Engineering)	1667	
6.	Horticultural Officer	3001	
7.	Agriculture Officer Extension	1678	LV, HH, LD, CP, LC, DF, AC, MuD
8.	Research Assistant	1861	LV, HH, LD, CP,LC, DF, AC, ASD
9.	Assistant Geologist	1863	LV, HI, HH, LD (with mobility), LC, DF, AC
10.	Junior Architect	1860	HI, LD(OL,BL), AC
11.	Architectural Assistant / Planning Assistant	2108	LV, HH, LD (OA, OL), AC, LC, DF
12.	Assistant Engineer	1661	HH
13.	Assistant Engineer (Civil)	3656	LD (OA, OL), HH, DF, AC
14.	Assistant Engineer (Electrical)	1657	
15.	Assistant Engineer (Civil)	1656	
16.	Assistant Manager (Civil)	3811	
17.	Assistant Manager (Electrical)	3812	
18.	Assistant Engineer (Mechanical)	3268	HH, LD(OA, OL), LC, AC,DF
19.	Assistant Engineer (Civil)	3230	LD(OA, OL), HH, LC, DF, AC
20.	Deputy Manager (Dairying)	3279	LD (OA, OL), HH, DF, AC
21.	Assistant Engineer	3269	LV,LD(OA,OL,OAOL), HH, AC, LC, DF
22.	Environmental Scientist	3606	LV,HI,HH,LD(OA,OL,BL,OAOL), LC,DF,AC

23.	Assistant Engineer	1660	HH,LD(OA,OL), LC,AC,DF
24.	Drug Inspector	1972	LD (Lower Limbs 40 to 70%)
25.	Assistant Manager (IT)	3810	AC, DF, HH
26.	Block Health Statistician	2010	All categories of benchmark disabilities
27.	Assistant Statistical Investigator	1824	
28.	Assistant Librarian	2013	
29.	Assistant General Manager / Regional Manager	3798	
30.	Assistant Archaeological Officer	1842	

**Abbreviations:**

LV – Low Vision	ASD – Autism Spectrum Disorder
BLOA – Both Leg One Arm	BL – Both Leg
HH – Hard of Hearing (with assistive device)	CP – Cerebral Palsy
HI – Hearing Impaired	LC – Leprosy Cured
LD – Locomotor Disability	AC – Acid Attack Victims
OA – One Arm	DF – Dwarfism
OL – One Leg	MuD – Muscular Dystrophy
OAOL – One Arm One Leg	SLD – Specific Learning Disability
MI – Mentally ill	MD – Multiple Disabilities

4.6.2. Persons with Benchmark Disability with only those category (ies) of disability (ies) mentioned above shall be eligible to apply for this Examination under Persons with Benchmark Disability category. Therefore candidates concerned are advised to read it carefully before applying appropriately for admission to the Examination.

**5. Plan of Examination:**

5.1. The Combined Technical Services Examination (Non-Interview Posts) will be conducted as single stage Written Examination. The candidates will be admitted to the examination, based on the claims made in the online application.

5.2. Onscreen certificate verification will be conducted before admission to the physical certificate verification and counselling. The Commission will draw a list of candidates to be qualified for the onscreen certificate verification based on the criterion of minimum qualifying marks as mentioned in para 6 of the notification and rule of reservation of appointments. The candidates will be admitted to onscreen certificate verification in the ratio of 1:3 / 1:2 for General category and all reserved categories respectively.

5.3. After onscreen certificate verification, based on the marks obtained in the written examination and subject to the rule of reservation of appointments, candidates will be admitted to physical certificate verification and counselling (wherever applicable). For the posts requiring counselling, the candidates will be admitted to physical certificate verification and counselling in the ratio of 1:3 and 1:1.5 for General category and all reserved categories respectively. For the posts not requiring counselling, candidates will be admitted to physical certificate verification in the ratio of 1:1.2 for all categories.

5.4. In respect of posts whose total cadre strength is one only and for which the rule of reservation of appointments does not apply, the number of candidates to be admitted to the physical certificate verification and counselling (wherever applicable) on the basis of the marks obtained in the written examination will be three.

5.5. The final selection will be made based on the total marks obtained by the candidate in the Examination (Part B and Part C of Paper I and Paper II) subject to rule of reservation of appointments. Candidates will be allowed to participate in counselling (wherever applicable) based on his/her rank.

**5.6. Ranking Procedure:**

5.6.1. The merit list or ranking list shall be prepared on the basis of total marks secured by the candidates in the written examination. Marks obtained by the candidates in the examination (Part B and Part C of Paper I and Paper II) would determine final ranking.

5.6.2. In case of two or more candidates scoring equal marks, the candidate possessing the higher qualification shall be placed above in the merit list.

5.6.3. When the marks obtained in the written examination and the qualification are also the same, then the candidate senior in age shall be placed above in the merit list.

5.6.4. When the age too is the same, then the candidate who has submitted his application earlier to the Commission, as determined from the application number, shall be placed above in the merit list.

5.6.5. Appearance in Paper I and Paper II is compulsory. Candidates who have not appeared either for Paper I or Paper II will not be considered for selection, even if they secure the minimum qualifying marks.

### 5.7. Physical Fitness for the post of Assistant Superintendent of Approved Schools (Post Code.2078):

Gender	Height (CM)	Chest Measurement	
		Full expiration (CM)	Chest expansion (CM)
Men	160	79	5
Women	145	71	2

5.7.1. Candidates possessing the above-said minimum physical standards are only eligible to apply for this post. The candidate should upload the certificate of physical standards obtained from a Medical Officer, above the rank of an Assistant Surgeon appointed by the Government to a Government Medical Institution in the format prescribed in Annexure V of Notification when called for by the Commission.

5.7.2. Senior Civil Surgeon, Civil Surgeon, Senior Assistant Surgeon, Resident Medical Officer, Assistant Professor, Senior Assistant Professor, Designate Professor of Medicine and Professor of Paediatrics are the competent authorities to issue the certificate of physical standards.

## 6. Scheme of Examination:

### 6.1. Posts other than Translator:

Subject	Standard	No. of Questions	Duration	Maximum Marks	Minimum Qualifying Marks		Type of Examination	Mode of Examination
					SCs, SC(A)s, STs, MBCs/DCs, BC(OBCM)s and BCMs	Others*		
<b>Paper I</b>	SSLC	100	3 hours	150	60	60	Objective	OMR
<b>Part A</b> Tamil Eligibility Test								
<b>Part B</b> General Studies								
<b>Part C</b> Aptitude and Mental Ability	SSLC	25						
<b>Paper II</b> Subject Paper	Degree / PG Degree	200	3 hours	300				CBT
Total (Part B and Part C of Paper-I and Paper-II)				450				
*Others - Candidates not belonging to SCs, SC(A)s, STs, MBCs/DCs, BC(OBCM)s and BCMs								
OMR - Optical Mark Recognition; CBT - Computer Based Test								

**6.1.1 Paper II – Subject Paper**

S. No.	Subject Paper	Subject Code	Standard	Language of Question Paper	Name of the Post	Post Code
1	Geology	395	PG Degree	English	Assistant Geologist	1677
					Assistant Geologist	1863
					Assistant Geologist	1750
2	Agricultural, Mechanical, Automobile and Civil Engineering	562	Degree	English	Assistant Engineer (Agricultural Engineering)	1667
3	Agriculture	491	Degree	Tamil and English	Agriculture Officer (Extension)	1678
4	Library and Information Science	594	Degree	Tamil and English	Librarian	1845
					Assistant Librarian	2013
5	Archaeology	420	PG Degree	Tamil and English	Archaeological Officer	1843
6	Archaeology, Epigraphy, Heritage Management and Museology	421	PG Diploma	Tamil and English	Assistant Archaeological Officer	1842
7	Computer Science, Information Technology, Electrical, Electronics and Communication Engineering	554	Degree	English	System Manager	3664
					Assistant Manager (IT)	3810
8	Pharmacy, Clinical Pharmacology and Micro Biology	516	Degree	English	Drug Inspector	1972
9	Evaluation and Applied Research	607	PG Degree	English	Research Assistant	1861
10	Statistics, Mathematics and Economics	504	Degree	Tamil and English	Block Health Statistician	2010
					Assistant Statistical Investigator	1824
11	Horticulture	493	Degree	Tamil and English	Horticultural Officer	3001
12	Basics of Engineering	422	Degree	Tamil and English	Assistant Engineer (Industries)	1900
13	Architecture	401	Degree	English	Junior Architect	1860
14	Civil Engineering	398	Degree	Tamil and English	Assistant Engineer (Civil)	3656
					Assistant Engineer (Civil)	3368
					Assistant Engineer (Civil)	3230
					Assistant Engineer	1660
					Assistant Engineer	1661
					Assistant Engineer (Civil)	1656
					Assistant Manager (Civil)	3811
15	Electrical, Electronics and Communication Engineering	514	Degree	English	Assistant Engineer (Electrical)	1657
					Assistant Manager (Electrical)	3812
16	Mechanical, Production and Manufacturing Engineering	399	Degree	Tamil and English	Assistant Engineer (Mechanical)	3611
					Assistant Engineer (Mechanical)	3268
					Junior Assistant Director of Boilers	3008
17	Business Administration	385	PG Degree	Tamil and English	Assistant General Manager / Regional Manager	3798

18	Agriculture, Chemistry, Zoology and Botany	518	Degree	English	Assistant Warehouse Manager / Junior Assistant	3388
19	Dairy Science, Dairy Technology, Food Technology, Food Processing	579	Degree	English	Deputy Manager (Dairying)	3279
20	Town Planning, Civil Engineering and Architecture	560	Degree	English	Architectural Assistant / Planning Assistant	2108
21	Visual Communication	477	Degree	English	Junior Photographer	3805
22	Criminology, Forensic Science, Psychology and Philosophy	571	Degree	English	Assistant Superintendent of Approved Schools (Men & Women)	2078
23	Statistics and Mathematics	506	PG Degree	English	Statistical Assistant	3125
24	Industrial Safety and Health	515	Degree	English	Assistant Director (Industrial Safety and Health)	1664
25	Chemistry	430	Degree	Tamil and English	Junior Chemist	3609
26	Environmental and Chemical Engineering	393	PG Degree	English	Assistant Engineer	3269
27	Environmental Science, Biology and Chemistry	557	PG Degree	English	Environmental Scientist	3606
28	Travel and Tourism	597	Degree	Tamil and English	Assistant Tourist Officer, Grade II	3111
29	Physics, Chemistry, Biology, Computer Science and Forensic Science	575	PG Degree	English	Junior Scientific Officer	1767
30	Financial and Cost Accountancy	433	Intermediate	English	Assistant Accounts Officer	3814

## 6.2. Translator Post:

Subject	Standard	No. of Questions	Duration	Maximum Marks	Minimum Qualifying Marks		Type of Examination	Mode of Examination
					SCs, SC(A)s, STs, MBCs/DCs, BC(OBCM)s and BCMs	Others*		
<b>Paper I</b>	SSLC	100	3 hours	150	60	60	Objective	OMR
<b>Part A</b> Tamil Eligibility Test								
<b>Part B</b> General Studies								
<b>Part C</b> Aptitude and Mental Ability	SSLC	25		150	75	100		
<b>Paper II</b> Translation	Degree	-	2 ½ hours	100			Descriptive	-
Total (Part B and Part C of Paper-I and Paper-II)				250				
*Others - Candidates not belonging to SCs, SC(A)s, STs, MBCs/DCs, BC(OBCM)s and BCMs								
OMR - Optical Mark Recognition								

6.3. The Paper II, Part B and Part C of Paper-I will be evaluated only if the candidate secures minimum qualifying marks of 40% (i.e., 60 Marks) in Part A of Paper I.

6.4. The questions in Part B and C of Paper I will be set both in English and Tamil.

6.5. The differently abled candidates can avail exemption from writing Part A in Paper I (Tamil Eligibility Test). Such candidates have to furnish the required details in the online application without fail. Subsequent claim will receive no attention. The candidates need to upload the Certificate of Disability in the format prescribed in Annexure II of this notification.

6.6. The syllabus for the written examination is available in Annexure III of this Notification. Unit-wise distribution of questions mentioned in the syllabus is only indicative. Commission reserves the right to marginally increase or decrease the number of questions in each unit if necessity arises.

6.7. The instructions to be followed while appearing for the examination, are available in Annexure IV of this Notification.

6.8. The Notification is published in English and Tamil versions. In case of doubt, English version is final.

## **7. Reservation of Appointments:**

The rule of reservation of appointments applies to this recruitment. The details of the reservation to candidates belonging to various categories are given in Annexure II of this Notification. In respect of posts whose total cadre strength is one only, the rule of reservation of appointment does not apply.

## **8. Communication to Candidates:**

8.1. The memorandum of admission (Hall Ticket) for eligible candidates will be made available on the Commission's website [www.tnpscexams.in](http://www.tnpscexams.in) for downloading by candidates. The memorandum of admission will not be sent by post. The candidates must comply with every instruction given in the memorandum of admission.

8.2. The Commission will publish the written examination results, list of candidates admitted for onscreen certificate verification, date and time of physical certificate verification, and counselling on the Commission's website [www.tnpsc.gov.in](http://www.tnpsc.gov.in). No individual communication will be sent to the candidates by post. Candidates will be informed of the above fact only through SMS and e-mail, through the registered Mobile Number and email ID. Candidates are directed to watch the Commission's website in this regard. The Commission shall not be responsible if the communication does not reach the candidate due to an incorrect / invalid e-mail ID /mobile number and failure / delay in delivery of SMS / email to the candidates due to any reason including technical issues. Any representation from the candidates for non-receipt of SMS or e-mail will not be responded.

## **9. Communication with the Commission:**

9.1. Candidates requiring clarification, can contact the office of the Tamil Nadu Public Service Commission in person or over the **Toll-Free No.18004190958** on all working days between 10.00 a.m. and 5.45 p.m.

9.2. Queries relating to One Time Registration / online application may be sent to [helpdesk@tnpscexams.in](mailto:helpdesk@tnpscexams.in). Any other communication with the Commission must be made through email to [grievance.tnpsc@tn.gov.in](mailto:grievance.tnpsc@tn.gov.in). Communications sent by post must be addressed only to the Secretary, Tamil Nadu Public Service Commission, TNPSC Road, V.O.C. Nagar, Park Town, Chennai -600003.

9.3. All communications to the Commission should invariably contain the following particulars. Communications not containing the following particulars will not be attended to

- a. Name and Year of the examination
- b. Notification No. and year

- c. Registration No.
- d. Name of the Candidate (in full and in block letters)
- e. Complete postal address as given in the application
- f. Valid and Active E-mail ID

9.4. Request for exemption from age limit or other qualifications will receive no attention. Requests for furnishing causes of failure in the written examination or for non-selection based on the results of the written examination or for revaluation of answer sheets will not be entertained.

9.5. Request for change of date and time for applying online / examination / physical certificate verification/counselling, relaxation of condition mentioned in the notification or examination related directions or guidelines or minimum marks or qualification/requirements etc. shall not be entertained

9.6. During the process of recruitment, from Notification till selection process, No information / clarification on the selection particulars / details will be furnished to any petitions / representations including petitions received under Right to Information Act.

9.7. As a part of Open Data Policy, all the disclosures will be made available in the Commission's website after the completion of the selection process.

#### **10. Litigations:**

The selection for appointment to the posts included in this recruitment is purely provisional subject to the final orders in the court cases, if any, pending before the Hon'ble High Court of Madras and Madurai Bench of Madras High Court, relating to this recruitment.

**Secretary**

## Annexure I

### How to Apply Online

1. **Website:** Candidates should apply only through online mode in the Commission's website viz., [www.tnpscexams.in](http://www.tnpscexams.in).

#### 2. One Time Registration:

2.1. It is essential for the candidate to register himself / herself first at the One Time Registration (OTR) platform, available on the Commission's website, and then proceed to fill up the online application for the examination. Candidates should register only once in the One Time Registration by paying Rs.150/- as registration fee. Successfully registered One Time Registration is valid for five years from the date of registration.

2.2. During One Time Registration, the candidates should keep ready the scanned image of their photograph, taken within the last 3 months of size 20 KB – 50 KB and saved as "Photograph.jpg" and signature of size 10 KB – 20 KB and saved as 'Signature.jpg'. Both photograph and signature, of 200 DPI resolution, should be saved in a CD / DVD / Pen drive, to upload the same.

2.3. One Time Registration is not an application for any post. It is just a collection of information from the candidates and provides a separate dashboard to each candidate to facilitate the maintenance of their own profile. A candidate should make an online application separately for every examination for which he / she intends to appear.

2.4. A valid e-mail ID and mobile number are mandatory for One Time Registration. E-mail ID and mobile number are to be kept in 'ACTIVE' mode. Every candidate should have his / her email ID and password. No candidate should share his/her e-mail ID, password, mobile number with any other person. In case a candidate does not have a valid personal email ID, he / she should create a new email ID before applying online and must maintain that email account live. Inquiries relating to One Time Registration / online applications will be answered only if the inquiries are received through a registered e-mail ID.

2.5. Linking the Aadhaar number with One Time Registration (OTR) is mandatory for candidates. The information associated with the Aadhaar number including biometrics will be used only for identification purposes and will not be stored or shared. Candidates are requested to give their consent in their respective OTR. The Aadhaar details will be submitted to the Central Identities Data Repository (CIDR) only for authentication. Linking of the Aadhaar number is mandatory for all prospective candidates to create new OTR, renew / access the existing OTR and apply for any recruitment to be notified henceforth.

#### 2.6. Details to be furnished during One Time Registration:

2.6.1. Candidates shall furnish their correct SSLC Register Number and Certificate Number, Month and Year of Passing, Medium of Instruction, and Name of the Board that issued the certificate while registering online. If any detail furnished is found to be wrong, the online application will be rejected at any stage after due process.

2.6.2. Candidates who have more than one SSLC mark sheet, should enter the details available in the mark sheet issued on the final attempt in which he / she had passed the SSLC examination.

2.6.3. Besides details related to SSLC, all other details required in the One Time Registration, shall be furnished without any mistake, as these details shall form the basis of all other details given subsequently by the candidate while filling the online application for each recruitment.

#### 2.7. One-Time Registration (OTR) Edit:

2.7.1. The candidates shall be permitted to edit the details in the OTR whenever required by uploading the supporting documents.

2.7.2. Any changes in the One Time Registration must be made before the submission of the online application since the details furnished in the One Time Registration will be filled in automatically in the online application. Hence, incorrect particulars furnished in the One Time Registration may result in the rejection of online application after due process. Candidates are therefore advised to fill in the One Time Registration particulars carefully and correctly.

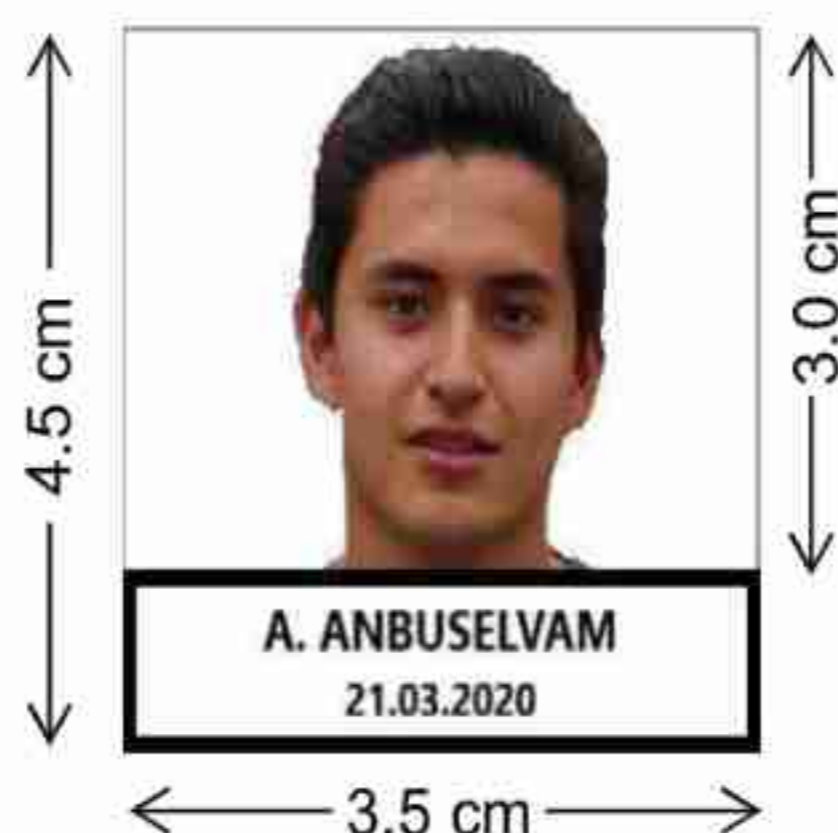
2.7.3. The Commission will not be responsible for any consequences arising out of failure on the part of the candidates to adhere to the instructions issued regarding One Time Registration or filling up of online application.

2.7.4. The instructions and illustration regarding One Time Registration are available on the website viz., [www.tnpscexams.in](http://www.tnpscexams.in).

### 3. Online Application:

3.1. A candidate who wishes to apply for any post shall click "APPLY" against the post notified on the Commission's website and use the same User ID and Password given for One Time Registration. User ID and Password are to be created by the candidates themselves. In case the candidate forgets the User ID and Password, he/she can retrieve or reset them using the "FORGOT PASSWORD and FORGOT USER ID" options. The Commission will not furnish User ID and Password details to the candidates.

3.2. A candidate already having user ID and password, has to login. The available One Time Registration particulars will be displayed on the screen, including the photograph furnished at the time of One Time Registration, as well as the photographs uploaded with previous online applications. Candidates shall check and confirm the One Time Registration details before proceeding further. Thereafter, the candidates shall fill up additional details required in the specific recruitment application. If any of the One Time Registration details are found to be incorrect, the same should be corrected by clicking on OTR Edit. Changes made in the One Time Registration will be reflected only in online applications to be submitted subsequently.



3.3. Candidates shall upload their photograph taken on or after the date of notification at the time of submission of each and every online application. The photograph should be in colour, of passport size, against a white background and taken in a photo studio. The candidate should be photographed in frontal view showing both ears and part of the neck. The candidate should ensure that the name of the candidate and the date of photography (i.e., on or after the date of notification) are printed at the bottom of the photograph. The face of the candidate as well as his / her name and date of photography should be clearly visible in the photograph of height 4.5 cm (170 pixels) and width 3.5 cm (130 pixels). Of the total height of the photograph, the image of the candidate shall be 3.0 cm (115 pixels) and the candidate's name and date of photography shall be 1.5 cm (55 pixels), as illustrated above. The photograph should be saved in a digital format (in CD / DVD / pen drive / hard drive), ready for uploading.

3.4. If the photograph is not available in a digital format, a passport-size photograph showing the image of the candidate along with the name of the candidate and the date of photography printed at the bottom, in the same dimensions as specified above, may be pasted on a plain white paper and

scanned to obtain a resolution of 200 DPI. The image should then be cropped to show only the photograph of size 20KB–50KB saved as “Photograph.jpg” and uploaded. The entire sheet of white paper on which the photograph is pasted should not be scanned / uploaded. Photographs taken using cellular phones, selfies, photocopies (Xerox) of photographs, photographs taken during family functions, at tourist places, or against a backdrop of plants or buildings should not be uploaded. Photographs of nature, wildlife, buildings, etc. shall not be uploaded. In case of uploading an inappropriate photograph, in violation of the aforementioned instruction, the application is liable to be rejected after due process.

3.5. Before uploading of signature, the candidate shall draw a box of dimension 6.0 x 2.0 cm (230 pixels x 75 pixels) on white paper and sign within the box, using a blue or black ink pen. The paper should then be scanned to obtain a resolution of 200 DPI. The image should then be cropped to show only the box with the signature, of size 10 KB –20KB, and saved as “Signature.jpg” and uploaded.

3.6. Clear images of the photograph and the signature should be uploaded in the correct dimensions, size, and format. Failure to upload/upload clear images of the photograph and signature will result in the rejection of the online application after due process.

### 3.7. Examination Centres:

3.7.1. While applying online, candidates shall be permitted to choose two district centres as their preference for the Written Examination. Candidates shall be allotted a venue in one of these two district centres. However, candidates with benchmark disability, shall be permitted to choose only one district centre and shall be allotted a venue in that district centre.

3.7.2. Candidates must appear for the examination at the venue they have been allotted, as mentioned in the memorandum of admission (hall ticket). Request for change of examination centre will not be permitted.

3.7.3. The Commission reserves the right to increase or decrease the number of examination centres and to re-allot the candidates accordingly. The Commission also reserves the right to allot a candidate to the nearby centre, if he / she could not be accommodated in the centres opted by the candidate.

3.7.4. The written examination will be held at the centres given below:

S.No.	Name of the Centre	Code	S.No.	Name of the Centre	Code
1.	Ariyalur	3001	21.	Ranipet	3501
2.	Chengalpattu	3301	22.	Salem	1701
3.	Chennai	0101	23.	Karaikudi	1805
4.	Coimbatore	0201	24.	Tenkasi	3601
5.	Chidambaram	0303	25.	Thanjavur	1901
6.	Dharmapuri	0401	26.	The Nilgiris	1301
7.	Dindigul	0501	27.	Theni	2001
8.	Erode	0601	28.	Thiruvallur	2101
9.	Kallakurichi	3401	29.	Thiruvannamalai	2201
10.	Kancheepuram	0701	30.	Thiruvarur	2301
11.	Nagercoil	0801	31.	Thoothukudi	2401
12.	Karur	0901	32.	Tiruchirappalli	2501
13.	Krishnagiri	3101	33.	Tirunelveli	2601
14.	Madurai	1001	34.	Tirupathur	3701
15.	Mayiladuthurai	3801	35.	Tiruppur	3201
16.	Nagapattinam	1101	36.	Vellore	2701
17.	Namakkal	1201	37.	Villupuram	2801
18.	Perambalur	1401	38.	Virudhunagar	2901
19.	Pudukkottai	1501			
20.	Ramanathapuram	1601			

### **3.8. Application Preview:**

3.8.1. Candidates should carefully fill in the details in the online application at the appropriate places and click on the 'SAVE AND PROCEED' button at the end of each page of the application. Before pressing the 'SAVE AND PROCEED' button, candidates are advised to verify each particular field in the application.

3.8.2. Candidates can edit/add/delete any information while filling the online application. Before finally submitting the application, candidates will be given the option of seeing a preview of their application. As soon as a candidate clicks the button meant for preview, an SMS will be sent to the registered mobile number, informing the availability of such a preview in the registered email ID provided by the candidate.

3.8.3. Once the candidate desires to make modifications based on the preview arrangement as indicated in the paragraph above, he/she may re-open the application and make necessary modifications using the Edit option and make the final submission of the corrected application, before the last date prescribed for submission of the online application. It is the responsibility of the candidate to carefully check the details available in the preview and make suitable corrections, if any, in the application / OTR before final submission. The candidate will be solely responsible for any non-rectification or non-submission of the application.

3.8.4. An individual is considered to have applied for a recruitment, if and only if, he / she finally submits the application, by clicking the 'SUBMIT' button. The mere availability of a preview shall not be tantamount to "having applied" for a particular recruitment.

### **3.9. Examination Fee:**

3.9.1. The examination fee of Rs.100/- (Rupees One hundred only) should be paid at the time of submitting the online application for this recruitment, unless exemption of fee is claimed.

3.9.2. For every additional subject paper opted by the candidate in the online application Rs.100 for each subject paper should be paid additionally. Further, if he/she withdraws one or more subject paper(s) then the fee already paid by the candidate will not be refunded.

3.9.3. Candidates belonging to special categories can avail of exemption from paying examination fees as per eligibility criteria. For further details refer to Annexure II of this Notification.

3.9.4. The total number of free chances availed, will be calculated based on claims made in previous applications. The number of free chances availed by the candidate may be verified by the Commission at any stage of the selection process. In case a candidate makes a false claim for exemption from payment of the application fee by suppressing information regarding his/her previous application(s), his / her candidature shall be rejected after due process and he / she shall be debarred for a period of one year, from appearing for examinations conducted by the Commission.

3.9.5. Candidates are directed to carefully choose the option "Yes" or "No" regarding availing of the fee concession. The choice made, cannot be modified or edited after successful submission of the online application. Candidates are advised in their own interest, to keep an account of the number of times fee concession has been availed, irrespective of the information displayed in the <Application History> of the candidate dashboard.

3.9.6. An application (irrespective of the post applied for) claiming fee concession will operate to exclude one chance from the number of free chances allowed. Candidates who have availed the maximum number of free chances permitted / candidates who do not wish to avail of the fee concession / candidates who are not eligible for fee concession shall choose the option "No" against the query regarding fee concession. Such candidates shall thereafter pay the requisite fee through the prescribed mode of payment.

3.9.7. Failure to pay the prescribed fee in time, along with the online application, will result in the rejection of the application after due process.

### **3.10. Examination Fee Payment:**

3.10.1. After submitting the details in the online application, the candidates can pay the examination fee by online mode through Net Banking / Credit card / Debit card / UPI on or before the last date of submission of the online application by choosing the option in the online application. Candidates have to pay the service charges also as applicable.

3.10.2. Offline mode of payment if any received in the form of Demand Draft / Postal Order etc. will not be accepted and the applications forwarded with such modes of payment will be summarily rejected and the same will not be returned or refunded.

3.10.3. To facilitate payment of fees through the online mode, an additional page of the application format will be displayed wherein candidates may follow the instructions and fill in the requisite details to make payment. There is a possibility of online payment failure. Hence, if the online payment fails, candidates can check the status of the earlier transaction. If the earlier transactions have failed, the candidate shall retry paying the fee again by online mode. In case of online payment failure, the amount debited from the candidate's account will be reverted to his/her account. The candidates have been given a provision to check the status of the transaction made. If all the attempts/transactions have failed, candidates have to make the payment again. The Commission is not responsible for online payment failure. It is the responsibility of the candidates to ensure that the transaction made by them is successful.

3.10.4. After submitting the payment information in the online application format, wait for the intimation from the server. Meanwhile, DO NOT press 'Back' or 'Refresh' button to avoid payment failure or double payment.

3.10.5. If the online transaction has been successfully completed, an Application Number / Applicant ID will be generated. Candidates should note the Application Number / ID for future reference in respect of the recruitment applied for.

3.10.6. Tamil Nadu Public Service Commission reserves the right to change the mode of payment at any time.

### **3.11. Online Application Edit:**

3.11.1. The candidates shall be permitted to edit all the details in the online application till the last date stipulated for submission of the online application.

3.11.2. If the candidate desires to change his / her photograph and/or signature in his / her online application, the candidate shall select the edit option in the online application to re-upload them which must be saved finally before submitting the online application.

3.11.3. Some of the information contained in the online application has been brought forward from the candidate's one-time registration. If such information has to be edited in the online application, the candidate shall select the edit profile option in One Time Registration (OTR) and shall make and save necessary corrections. After doing so, the candidate shall select the edit option in the online application and edit the details as desired. The candidate shall save the changes and submit it finally. The candidate shall take a printout of the same if required.

3.11.4. After editing the online application, if the edited details are not finally saved and submitted by the candidate, the details provided by the candidate in the application submitted before editing shall only be considered. If the candidate has to pay a fee based on the edited details, the candidate shall pay the prescribed examination fee in online. Candidates who have already paid the examination fee are not required to pay.

### **3.12. Application Correction Window:**

3.12.1. After the last date for submission of the online application, the Online Application Correction Window shall open for 3 days as mentioned in Para 1 'Important Instructions' of this Notification. During this period, candidates will be able to edit the details in their online application. After the last date of the Correction Window period, no modification is allowed in the online application.

3.12.2. The applications shall be processed as per the details finally furnished by the candidates. It is the responsibility of the candidates and the Commission has no liability for subsequent rejection of the application consequent to the editing details already submitted in the online application. Request / representation received for modification of claims in the online application, in any mode shall not be entertained.

3.13. Candidates are advised in their own interest to apply online much before the closing date and not to wait till the last date to avoid the possibility of disconnection / inability / failure to log on to the Commission's website on account of heavy load on internet / website.

3.14. The Commission does not assume any responsibility for the candidates not being able to submit their online applications within the last date on account of the aforesaid reasons or for any other reason beyond the control of the Commission.

3.15. Candidates need not send the printout of the online application or any other supporting documents to the Commission by post unless asked for specifically.

3.16. The name of the candidate or the name of his / her father or mother, should be spelt correctly in the application as it appears in the certificates / mark sheets.

3.17. Any discrepancy between the details as given in the online application and the documents submitted shall result in the summary rejection of candidature after due process.

3.18. The Commission will not be responsible for any consequences arising out of furnishing of incorrect and / or incomplete details in the application or omission to provide the required details in the application.

### **3.19. Upload of Documents:**

3.19.1. Candidates should upload the required documents of proof in respect of all the claims made in the application with reference to this notification while applying for this examination. If the required certificates are not uploaded by the candidate, within the stipulated time, his/her candidature will be rejected after due process.

3.19.2. The candidates shall have the option of verifying the uploaded certificates / documents through their OTR. If any of the certificates / documents have wrongly been uploaded or not uploaded or if any modifications are to be done in the uploading of documents, the candidates shall be permitted to upload / re-upload the documents till two days prior to the date of hosting of hall tickets for that particular examination. (i.e., twelve days prior to the date of examination).

3.19.3. The uploaded credentials shall be mapped with the One Time Registration of the respective candidate along with the Application number and Notification Number (i.e., with reference to the notification for each post), so that they can be used during future submission of application by the same candidates.

3.19.4. The documents uploaded by the candidates shall be linked with OTR and retained in the server for a maximum period of two years. If the candidate applies subsequently for other posts within two years, the documents that were already uploaded shall be displayed to the candidate during the online application process for confirmation and the same need not once again be uploaded by the candidates. If the candidate applies to other posts after the period of retention i.e. two years, the candidate shall be instructed to upload all the documents afresh.

#### **4. Information regarding criminal cases / disciplinary cases:**

4.1. Candidates who have declared pending criminal or disciplinary cases in their online application, must upload a copy of the First Information Report (FIR) or memorandum of charges / show cause notice, as the case may be. Failure to upload such papers at the time of submission of online application, shall result in rejection of candidature after due process.

4.2. Candidates who have declared conviction in criminal cases or punishment in disciplinary cases, in their online application, must upload the relevant court orders and / or release orders or memorandum of proceedings, as the case may be, at the time of submission of online application. Failure to upload such papers shall result in the rejection of candidature after due process.

4.3. In case any criminal case is filed / disciplinary action is taken against or conviction / punishment is imposed on a candidate after submission of the online application, at any stage of the recruitment process before the completion of the entire selection process, such candidates should report this fact to the Commission in the next immediate stage when Commission calls for uploading documents. Failure to comply with these instructions shall result in the rejection of candidature after due process and debarment for a period of one year.

4.4. The pendency of disciplinary cases / criminal cases shall in no way affect the selection prospects of candidates. However, failure to inform such pendency, shall result in the rejection of candidature after due process.

4.5. The selection of the candidates against whom the criminal case / disciplinary case is pending, will be withheld subject to the outcome of the pending criminal / disciplinary case.

#### **5. Employment Details:**

5.1. Candidates who are in the service of the Indian Union or a State in India or in the employment of Local Bodies or Universities or Quasi Government Organizations or Public Sector Units constituted under the authority of the Government of India or of a State in India, in regular service, must inform the Commission of such fact, at the time of applying. Suppression of the fact of employment by candidates shall result in rejection of candidature after due process.

5.2. Candidates need not send their applications through their Head of Department or employer. Instead, they may directly apply to the Commission after duly informing their employer in writing that they are applying for the particular recruitment, subject to the condition that they should produce 'No Objection Certificate' in the format prescribed as shown below.

#### **No Objection Certificate**

This is to certify that Thiru/Tmt./Selvi. .... (Name) employed as ..... (designation) in this office from .....(specify the date from which appointed), who is regularly / temporarily appointed and who is as probationer / approved probationer / full member, had applied for the post of .....in .....service called for by the Tamil Nadu Public Service Commission through online application form to the Tamil Nadu Public Service Commission and informed the fact to this department / organisation. This department / organisation has 'no objection' for processing the said application of the individual by the Tamil Nadu Public Service Commission subject to the condition that the particulars furnished by the individual are found to be correct.

Appointing Authority  
(Signature with Seal)

\* In the case of a Government servant against whom departmental or criminal proceedings are contemplated or pending, the appointing authority shall inform the said fact to the Tamil Nadu Public Service Commission along with the "No Objection Certificate" and shall also inform the Tamil Nadu Public Service Commission about the initiation of departmental or criminal proceedings, if any, subsequently, till the date of his / her actual relief from the office to take up appointment in the post for which he / she has been selected.

5.3 Candidates who secure employment after submission of online application, must upload a 'No Objection Certificate' or at least an undertaking regarding the fact of employment and that 'No Objection Certificate' has been applied for. Failure to upload the 'No Objection Certificate' / an undertaking shall result in the rejection of candidature after due process.

5.4. Candidates who have been removed / dismissed / resigned from a post, shall intimate such fact to the Commission, through the One Time Registration Dashboard. Any failure in this regard shall result in the rejection of the candidature after due process.

5.5. Any change in the employment status of the candidate, whether appointment to or resignation / removal / dismissal, from a post, at any stage of the recruitment process, until completion of the entire selection process, must be informed to the Commission. Any failure in this regard shall result in the rejection of the candidature after due process.

5.6. Failure on the part of employed candidates to upload the 'No Objection Certificate' shall result in the rejection of candidature after due process.

## Annexure II

### 1. Ex-Servicemen:

#### 1.1. 'Ex-Serviceman' means,

1.1.1. Any person who had served in any rank (whether as combatant or not) in the Armed Forces of the Union for a continuous period of not less than six months after attestation, if released between 1st July 1979 and 30th June 1987 (both days inclusive):

- a. for reasons other than at his own request or by way of dismissal or discharge on account of misconduct or inefficiency; or
- b. at his own request after serving for a period of not less than five years; or

1.1.2. Any person who had served in any rank (whether as combatant or not) in the Armed Forces of the Union, and had retired or had been released on or after 1st July 1987 from such service:

- a. at his own request after earning his pension; or
- b. on medical grounds attributable to military service or circumstances beyond his control and awarded medical or other disability pension; or
- c. otherwise than at his own request after earning his pension, as a result of reduction in establishment; or
- d. after completing specific period of engagement, otherwise than at his own request or by way of dismissal or discharge on account of misconduct or inefficiency and has been given a gratuity.

1.1.3. Any person of the Territorial Army of the following categories, namely, pension holder for continuous embodied service, person with disability attributable to military service and gallantry award winner retired on or after 15th November 1986; or

1.1.4. Any person of the Army Postal Service, who retired on or after 19th July 1989 directly from the said service without reversion to Postal and Telegraph Department with pension or who has been released on or after 19th July 1989 from such service on medical grounds attributable to military service or circumstances beyond his control and awarded medical or other disability pension; or

1.1.5. Any person who was on deputation in the Army Postal Service for more than 6 months prior to the 14th day of April 1987; or

1.1.6. Any person who was boarded out or released on medical grounds and granted medical or disability pension; or

1.1.7. Any person discharged on or after July 1987 under Army Rule 13(3) III (V) for the reason that his service is no longer required and in receipt of pension; or

1.1.8. Such other person as may be notified by the Government from time to time.

1.2. Ex-Servicemen does not mean the wards / dependents of those mentioned above.

1.3. A person discharged before July 1987 under Army Rule 13(3) III (V) for the reason that his service is no longer required is not an Ex-Serviceman.

1.4. In all cases, an Ex-Serviceman once recruited to a post in any class or service or category, cannot claim the concession of being called an Ex-Serviceman for his further recruitment.

1.5. Persons serving in the Armed Forces shall be eligible to apply for posts under the Government, if they are due to complete the specified term of their engagement in the Armed Forces, within one year from the last date prescribed by the Commission, for receipt of the online application in respect of a particular recruitment.

**1.6. Fee Concession:** Two free chances.

**1.7. Reservation of Appointments:** The rule of reservation of appointment to Ex-Servicemen is applicable only for the posts upto Level 12 in the Pay Matrix in the notification. If no qualified and suitable Ex- Servicemen belonging to a particular category is available for selection for appointment against reserved turn, such turn shall be filled up by a candidate other than Ex-Servicemen belonging to the particular communal category.

**1.8. Supporting Documents:**

1.8.1. A candidate who claims to have been demobilised from the Army or Navy or Air Force needs to upload / produce both the properly authenticated extract from his Discharge Certificate (viz., a Bonafide Certificate) issued by the Ex-Servicemen's Welfare Board in the format as depicted below and the Pension Pay Order at the time of submission of online application.

**Form of Bonafide Certificate to be produced by Ex-Servicemen**

1. Name of the applicant
2. Rank held, Name of the Service (Army / Navy / Air force)
3. Date of enrolment
4. Date of discharge
5. Reasons for discharge
6. Whether an 'Ex-Serviceman' should be specifically stated
7. Whether in receipt of pension
8. P.P.O No.
9. Conduct and character while serving in the defence forces
10. Name of the post applying for
11. Unique Service No.
12. Whether the individual is employed in any post under the Government of Tamil Nadu? If so, Name of the post and date of appointment

1.8.2. Persons serving in the Armed Forces who are due to complete the specified term of their engagement in the Armed Forces, within one year from the last date prescribed by the Commission, for receipt of the online application in respect of this recruitment, shall upload at the time of submission of online application an undertaking and a certificate from their Commanding Officer in the format as depicted below.

**Form of Undertaking to be given by the Serving Personnel**

I hereby accept that if selected on the basis of the recruitment / examination to which this application relates, I will produce documentary evidence to the satisfaction of the appointing authority that I have been duly released / retired / discharged from the Armed Forces and I am entitled to the benefits admissible to Ex-Servicemen given under Section 63 of the Tamil Nadu Government Servants (Conditions of Service) Act, 2016.

Place:

Signature of the Applicant

### Form of Certificate for Serving Personnel

I hereby certify that according to the information available with me (Number) .....(Rank) .....  
(Name) is due to complete the specified term of his engagement with the Armed Forces on the (date)  
.....

Place:  
Date:

Signature of the Commanding Officer

1.8.3. The candidates should also submit the Self Declaration in the format given below.

#### Self Declaration

1) I am aware of the fact that, as per the proviso to Section 3 (j) and 3(y) of the Tamil Nadu Government Servants (Conditions of Service) Act, 2016 (Tamil Nadu act 14 of 2016) and as per note II under para.4-A of the Commission's Instructions to Applicants, "In all cases, an ex-serviceman once recruited to a post in any class or service or category, cannot claim the concession of being called an ex-serviceman for his further recruitment".

2) I am also aware of the fact that as per para.14(P)(V) of the Commission's Instructions to Applicants "Any change in the employment status of the candidate, whether appointment to, or resignation / removal / dismissal, from a post, at any stage of the recruitment process, until completion of the entire selection process, must be informed to the Commission. Any failure in this regard shall result in rejection of candidature after due process"

3) Knowing the above facts, I (Ex.No.....) Ex.Rank.....  
Name .....of .....District hereby declare that I have never been employed in any post in any class or service or category classified under State service or Subordinate service of Tamil Nadu.

4) Knowing the above facts, I (Ex.No.....) Ex.Rank.....  
Name .....of.....District hereby declare that I have been employed in ..... State service or Subordinate service of Tamil Nadu as .....from.....to.....after my retirement from the Armed Forces. I also enclose herewith the No Objection Certificate obtained from my employer.

5) Further, if the above declaration is found to be false, I may be subjected to any departmental / legal/ penal action as deemed fit and my candidature to the said examination will be cancelled by the Commission after due process.

(\*Strikeout whichever is not applicable)

Date : Signature :  
Place : Name :  
Register No. :  
Ex. No. :  
Rank :  
Mobile No. :

1.8.4. Failure to upload the supporting documents at the time of submission of online application shall result in the rejection of claim after due process.

## **2. Persons with Benchmark Disability:**

2.1. "Person with Benchmark Disability" means a person with not less than forty percent of a specified disability where specified disability has not been defined in measurable terms and includes a person with disability where specified disability has been defined in measurable terms, as certified by the certifying authority designated by the Government under sub-section (1) of section 57 of the Rights of Persons with Disabilities Act, 2016.

**2.2. Fee Concession:** Full exemption.

**2.3. Reservation of Appointments:** (For posts identified suitable for persons with benchmark disabilities) Out of the total number of appointments to be made in the communal reservation categories, viz., Scheduled Castes / Scheduled Caste - Arunthathiyars (on preferential basis) / Scheduled Tribes / Most Backward Classes / Denotified Communities / Backward Classes (other than Muslim) / Backward Classes (Muslim) and General Turn, in the case of appointment made by direct recruitment, 1% each shall be reserved for persons with benchmark disabilities under categories (a), (b) and (c) and 1% for persons with benchmark disabilities under categories (d) and (e) both taken together, namely:

- a. blindness and low vision;
- b. deaf and hard of hearing;
- c. locomotor disability including cerebral palsy, leprosy cured, dwarfism, acid attack victims and muscular dystrophy;
- d. autism, intellectual disability, specific learning disability and mental illness;
- e. multiple disabilities from amongst persons under categories (a) to (d) including deaf-blindness in the posts identified for each disability.

## **2.4. Supporting Documents:**

2.4.1. The Persons with Benchmark Disability shall ensure that the Differently Abled Certificates to be uploaded by them contain, among other things the following aspects.

- a. The exact sub-category (i.e. One Arm, One Leg, etc.,) as claimed by them in their online application.
- b. Affected part of the body.
- c. The percentage of disability.
- d. They should also ensure that the Differently Abled Certificate has been issued by the competent authority / authorities specified in para 2.4.3 table I & II of this notification.
- e. The signature, seal, designation and speciality of the issuing authority are clearly visible and
- f. The Differently Abled Certificate is valid as on the date.

2.4.2. If the Differently Abled Certificate already possessed by them does not contain any one or more the above aspects, such candidates shall obtain and upload a fresh Differently Abled Certificate in the format prescribed Form VIII of this notification. Failure to do so will lead to rejection of their application / claim after due process.

2.4.3. The Persons with Benchmark Disability should produce Disability Certificate at the time of online application in the format shown below, prescribed in the Rights of Persons with Disabilities Rules, 2017 and issued by the competent authority as mentioned below;

**Form V**  
**Certificate of Disability**

**(In cases of amputation or complete permanent paralysis of limbs or dwarfism and in case of blindness)**

(Name and Address of the Medical Authority issuing the Certificate)

Recent passport size  
attested photograph  
(Showing face only) of  
the person with  
disability.

Certificate No. \_\_\_\_\_

Date: \_\_\_\_\_

This is to certify that I have carefully examined Shri./ Smt./ Kum. \_\_\_\_\_  
Son / wife / daughter of Shri. \_\_\_\_\_ Date of Birth (DD/ MM/YY) \_\_\_\_\_ Age \_\_\_\_\_  
years, male / female Registration No. \_\_\_\_\_ permanent resident of House No. \_\_\_\_\_ Ward /  
Village / Street Post Office \_\_\_\_\_ District State \_\_\_\_\_, whose photograph is affixed above,  
and am satisfied that:

(A) he / she is a case of:

- locomotor disability
- dwarfism
- blindness

(Please tick as applicable)

(B) the diagnosis in his / her case is \_\_\_\_\_

(C) he / she has \_\_\_\_\_% (in figure) \_\_\_\_\_ percent (in words) permanent locomotor disability/  
dwarfism/ blindness in relation to his / her \_\_\_\_\_ (part of body) as per guidelines  
(..... number and date of issue of the guidelines to be specified).

2. The applicant has submitted the following document as proof of residence:-

Nature of Document	Date of Issue	Details of authority issuing certificate
--------------------	---------------	--

(Signature and Seal of Authorized Signature of notified Medical Authority)

Signature/ thumb  
impression of the  
person in whose favour  
certificate of disability is  
issued.

**Form VI**  
**Certificate of Disability**  
**(In cases of multiple disabilities)**  
(Name and Address of the Medical Authority issuing the Certificate)

Recent passport size  
attested photograph  
(Showing face only) of  
the person with  
disability.

Certificate No. \_\_\_\_\_

Date. \_\_\_\_\_

This is to certify that we have carefully examined Shri./ Smt./ Kum. \_\_\_\_\_ son/ wife/ daughter of Shri \_\_\_\_\_ Date of Birth (DD/ MM/ YY) \_\_\_\_\_ Age \_\_\_\_\_ years, male/ female \_\_\_\_\_ Registration No. \_\_\_\_\_ permanent resident of House No. \_\_\_\_\_ Ward/ Village/ Street \_\_\_\_\_ Post Office \_\_\_\_\_ District \_\_\_\_\_ State \_\_\_\_\_, whose photograph is affixed above, and am satisfied that:

(A) he/ she is a case of Multiple Disability. His/ her extent of permanent physical impairment/ disability has been evaluated as per guidelines (..... number and date of issue of the guidelines to be specified) for the disabilities ticked below, and is shown against the relevant disability in the table below:

Sl. No.	Disability	Affected part of body	Diagnosis	Permanent physical impairment/ mental disability (in%)
1.	Locomotor disability	@		
2.	Muscular Dystrophy			
3.	Leprosy cured			
4.	Dwarfism			
5.	Cerebral Palsy			
6.	Acid attack Victim			
7.	Low vision	#		
8.	Blindness	#		
9.	Deaf	£		
10.	Hard of Hearing	£		
11.	Speech and Language disability			
12.	Intellectual Disability			
13.	Specific Learning Disability			
14.	Autism Spectrum Disorder			
15.	Mental illness			
16.	Chronic Neurological Conditions			
17.	Multiple sclerosis			
18.	Parkinson's disease			
19.	Haemophilia			
20.	Thalassemia			
21.	Sickle Cell disease			

(B) In the light of the above, his/ her over all permanent physical impairment as per guidelines (.....

number and date of issue of the guidelines to be specified), is as follows : -

In figures :- ----- percent

In words :- ----- percent

2. This condition is progressive/ non-progressive/ likely to improve/ not likely to improve.

3. Reassessment of disability is:

(i) not necessary, or

(ii) is recommended/ after ..... years ..... months, and therefore this certificate shall be valid till --- --- ---

(DD) (MM) (YY)

@ e.g. Left/ right/ both arms / legs

# e.g. Single eye

£ e.g. Left/ Right/ both ears

4. The applicant has submitted the following document as proof of residence:-

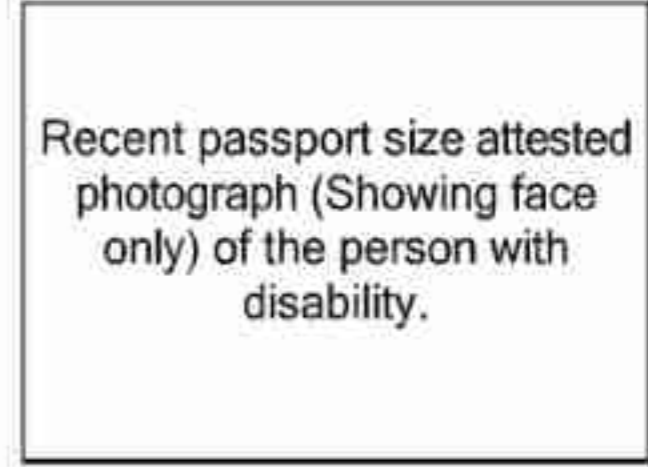
Nature of document	Date of issue	Details of authority issuing certificate
--------------------	---------------	--

5. Signature and seal of the Medical Authority.

Name and Seal of Member	Name and Seal of Member	Name and Seal of the Chairperson
-------------------------	-------------------------	----------------------------------

Signature/ thumb impression of the person in whose favour certificate of disability is issued.
--

**Form VII**  
**Certificate of Disability**  
**(In cases other than those mentioned in Forms V and VI)**  
(Name and Address of the Medical Authority issuing the Certificate)



Certificate No. \_\_\_\_\_

Date. \_\_\_\_\_

This is to certify that I have carefully examined Shri./ Smt./ Kum. \_\_\_\_\_ son / wife / daughter of Shri \_\_\_\_\_ Date of Birth (DD/ MM/ YY) \_\_\_\_\_ Age \_\_\_\_\_ years, male/ female \_\_\_\_\_ Registration No. \_\_\_\_\_ permanent resident of House No. \_\_\_\_\_ Ward/ Village/ Street \_\_\_\_\_ Post Office \_\_\_\_\_ District \_\_\_\_\_ State \_\_\_\_\_, whose photograph is affixed above, and am satisfied that he/ she is a case of \_\_\_\_\_ disability. His/ her extent of percentage physical impairment/ disability has been evaluated as per guidelines (..... number and date of issue of the guidelines to be specified) and is shown against the relevant disability in the table below:-

Sl. No.	Disability	Affected part of body	Diagnosis	Permanent physical impairment/mental disability (in %)
1.	Locomotor disability	@		
2.	Muscular Dystrophy			
3.	Leprosy cured			
4.	Cerebral Palsy			
5.	Acid attack Victim			
6.	Low vision	#		
7.	Deaf	€		
8.	Hard of Hearing	€		
9.	Speech and Language disability			
10.	Intellectual Disability			
11.	Specific Learning Disability			
12.	Autism Spectrum Disorder			
13.	Mental illness			
14.	Chronic Neurological Conditions			
15.	Multiple sclerosis			
16.	Parkinson's disease			
17.	Haemophilia			
18.	Thalassemia			
19.	Sickle Cell disease			

(Please strike out the disabilities which are not applicable)

2. The above condition is progressive / non-progressive / likely to improve / not likely to improve.

3. Reassessment of disability is:

(i) not necessary, or

(ii) is recommended/ after \_\_\_ years \_\_\_ months, and therefore this certificate shall be valid till (DD/ MM/ YY) \_\_\_\_\_

@ - eg. Left/ Right/ both arms/ legs

# - eg. Single eye/ both eyes

€ - eg. Left/ Right/ both ears

4. The applicant has submitted the following document as proof of residence:-

Nature of Document	Date of Issue	Details of authority issuing certificate
--------------------	---------------	--

(Authorized Signatory of notified Medical Authority)  
(Name and Seal)

Countersigned  
{Countersignature and seal of the  
Chief Medical Officer/ Medical Superintendent/  
Head of Government Hospital, in case the  
Certificate is issued by a medical authority who is  
not a Government servant (with seal)}

Signature/ thumb impression of the person in whose favour certificate of disability is issued.
--

**Form VIII  
Certificate of Disability**

Photograph of the candidate with the signature of the issuing authority
--

1. This is to certify that, I have carefully examined the following individual, whose photograph is affixed above, as per the existing guidelines and satisfied that he /she is a differently abled person as detailed below:

Name	
Name of the Father / Mother	
Date of Birth	
Age	
Full Address	

2. Tick the relevant box

a)	Low Vision (LV)	
	Visually Impaired (VI)	
b)	Hard of Hearing (HH) (with assistive device)	
	Hearing Impaired (HI)	
c)	Locomotor Disability	
i	One Arm (OA)	
ii	One Leg (OL)	
iii	Both Legs (BL)	
iv	Both Arms (BA)	
v	One Arm One Leg (OAOL)	
vi	Both Leg One Arm (BLOA)	
vii	Both Arm Both Leg (BABL)	
viii	Cerebral Palsy (CP)	
ix	Leprosy Cured (LC)	
x	Dwarfism (DF)	
xi	Muscular Dystrophy (MuD)	

xii	Acid Attack Victims (AC)	
xiii	LD - Others (Scoliosis and/ or Kyphoscoliosis, Kyphosis, Spinal Cord Injuries and Spine Kyphoscoliosis)	
d)	Autism Spectrum Disorder (ASD)	
	Specific Learning Disability (SLD)	
	Mentally ill (MI)	
	Intellectual Disability	

3. 

Affected Part of the body	
---------------------------	--

4. 

Percentage of Disability	
--------------------------	--

5. 

The condition is :	Non-Progressive	
	Progressive	

6. Re-assessment of disability is:

a) Not Necessary

b) Recommended after  Years and  Months

7. Details of the Issuing Authority

Signature with date	
Name	
Designation	
Name of the Speciality	
Name of the Institution with Seal	

a) Date of Issue :

b) Place of Issue :

Signature / Thumb  
impression of the Person in  
whose favour the  
certificate  
is issued

**List of Certifying Authority for the issue of disability certificate**

**TABLE – I**

S. No.	Specified disability	Medical Authority for the purpose of the issue of disability certificate	Certifying authority to issue certificate of disability
1	In case of amputation or complete permanent paralysis of limbs or dwarfism	Hospitals/ Institutions/ Primary Health Centres run by Central and State Government/ Statutory Local bodies	Any doctor/ medical practitioner working in the Hospitals/ Institutions/ Primary Health Centres run by Government/ Statutory Local bodies.
2	Multiple Disability	District Hospital/ Other hospitals/ Institutions run by Central and State Government /Statutory Local Bodies having relevant medical specialist and testing/assessment facilities	Medical Board consisting of three members of whom two will be specialist dealing with relevant disabilities
3	Specified Disabilities not mentioned in Serial numbers 1 & 2 above	Hospitals / Primary Health Centers / Institutions run by Central and State Government/ Statutory Local bodies having relevant medical specialist and testing / assessment facilities	A specialist dealing with the relevant disability as specified in the Table - II given below

**TABLE – II**

Sl. No.	Category	Specialist
1	Locomotor disability other than amputation or complete permanent paralysis of limbs and dwarfism	Specialist in Physical Medicine and Rehabilitation or Orthopaedician.
2	Muscular Dystrophy	Specialist in Physical Medicine and Rehabilitation or Orthopaedician.
3	Leprosy cured person	Specialist in Physical Medicine and Rehabilitation or Orthopaedician.
4	Cerebral Palsy	Specialist in Physical Medicine and Rehabilitation or Orthopaedician.
5	Acid Attack Victim	Specialist in Physical Medicine and Rehabilitation or Orthopaedician.
6	Blindness	Specialist in the field of Ophthalmology.
7	Low Vision	Specialist in the field of Ophthalmology.
8	Deaf	Specialist in the field of Ear, Nose, Throat (E.N.T).
9	Hard of Hearing	Specialist in the field of Ear, Nose, Throat (E.N.T).
10	Speech and Language Disabilities	Specialist in the field of Ear, Nose, Throat (E.N.T) and Neurologist.
11	Intellectual Disability	Adults with intellectual disability above the age group of 18 years – Psychiatrist.
12	Specific Learning Disabilities	Medical board consisting of a) Paediatrician; and b) Psychiatrist and Trained Psychologist.
13	Autism spectrum disorder	Medical Board consisting of a) Psychiatrist and Trained psychologist; and b) Paediatrician or General Physician.
14	Mental Illness	Psychiatrist.

15	Chronic Neurological Conditions such as Multiple Sclerosis and Parkinson's Disease	Medical Board consisting of a) Psychiatrist and Trained Psychologist; and b) Neurologist; and c) Orthopaedician or Specialist in Physical Medicine and Rehabilitation.
----	--	---

2.4.2. In case the certificate is issued by a medical authority who is not a Government servant, it shall be valid only if countersigned by the Joint Director, Medical Services.

2.4.3. The disability claimed in the online application, shall be exactly the same as stated in the Disability Certificate. Any discrepancy in this regard shall result in rejection of claim after due process.

2.4.4. Claim as person with benchmark disability, unsupported by the prescribed documents shall result in rejection of claim after due process.

### 3. Destitute Widow:

3.1. "Destitute Widow" means a widow whose total monthly income from all sources shall not be more than Rs.8,000/-(Rupees Eight Thousand only), including any family pension or other receipts including income from private practice in the case of professionals. Destitute Widow shall not include a divorcee or a woman deserted by her husband. The status of an individual as Destitute Widow is with reference to the date of notification.

**3.2. Fee Concession:** Full exemption.

**3.3. Reservation of Appointments:** The rule of reservation of appointment to Destitute Widow candidates will apply for this recruitment. 10% of vacancies out of 30% of vacancies set apart for Women candidates in direct recruitment are reserved for Destitute Widows. The reservation of appointment to Destitute Widow is applicable only for the post which does not exceed Level-10 in the pay matrix in this notification. If no qualified and suitable destitute widow is available, then, the turn so set apart for destitute widow shall go to the women / Transgender (Women) (other than destitute widow) belonging to the respective category

### 3.4. Supporting Documents:

3.4.1. The Destitute Widows should upload a certificate from the Revenue Divisional Officer or the Assistant Collector or the Sub-Collector concerned, in the format prescribed below. Failure to upload such certificate or uploading of a widow or divorcee certificate, at the time of submission of online application, shall result in rejection of claim after due process.

#### Form of Destitute Widow Certificate

1. Name of the individual
2. Full Postal Address
3. Details of job held, if any:
4. Particulars of her children, if any
5. Name and last occupation of her late husband
6. Date of demise of her husband
7. Monetary benefits received after her husband's death by way of family pension, insurance, etc., if any
8. Details of Properties if any immovable and movable left behind by him
9. Present monthly income
  - a. From salaries/wages
  - b. From family pension
  - c. From private properties
  - d. Rents received
  - e. From private practice
  - f. Other sources, if any
  - g. Total

10. Whether living alone or living with her husband's parents / in-laws / parents / brother(s)  
11. Whether she satisfies the definition of the term "Destitute Widow" as defined in section 20(8) and 26 of Tamil Nadu Government Servants (Conditions of Service) Act, 2016.

Certified that I have verified the particulars furnished by the individual and satisfied myself as to the correctness of her claim with reference to the definition of the term – "Destitute Widow" in section 20(8) and 26 of Tamil Nadu Government Servants (Conditions of Service) Act, 2016.

Certificate Reference No.:

Signature:

Place:

Name:

Date:

Designation:

Revenue Divisional Officer / Assistant Collector / Sub-Collector

Explanation - The above certificate should be issued only by the Revenue Divisional Officer or the Assistant Collector or the Sub-Collector concerned.

3.4.2. A 'Widow Certificate' is different from a 'Destitute Widow Certificate'. Candidates who have uploaded Widow Certificates will not be considered as Destitute Widow.

3.4.3. Claim as Destitute Widow shall be admitted only if the date of demise of husband is on or before the date of notification.

3.4.4. Any correction in the Destitute Widow certificate must be attested by the issuing authority or a fresh certificate in lieu thereof must be uploaded.

#### **4. Person Studied in Tamil Medium (PSTM):**

4.1. "Person Studied in Tamil medium" means a person who has studied through Tamil medium of instruction up to the educational qualification prescribed for direct recruitment in the rules or regulations or orders applicable to any appointment in the services under the State.

4.1.1. In cases where a Degree is prescribed as the educational qualification, one shall have studied from first standard to Degree through Tamil medium of instruction.

4.1.2. The candidates who did not join school in the 1<sup>st</sup> standard, but joined schools directly in 2<sup>nd</sup> standard to 8<sup>th</sup> standard under the Right to Education Act on the basis of age, studied in Tamil as the medium of instruction and passed, and those who studied with Tamil as the medium of instruction in other states and then continued their education in Tamil Nadu from the standard they entered are also eligible.

4.1.3. Students who have studied in Tamil medium in regular stream in 10<sup>th</sup>, 11<sup>th</sup> and 12<sup>th</sup> standard and failed to pass one or more subjects in them, but have later passed in the subject as private students and have continued to study in schools and colleges in Tamil medium and have passed are eligible to be considered under PSTM category.

4.1.4. The candidates who have passed the examination through Tamil medium directly as private candidates without going to school are not eligible to be considered under PSTM category.

#### **4.2. Supporting Documents:**

4.2.1. Candidates claiming to be Persons Studied in Tamil Medium (PSTM) must upload evidence for the same, in the form of SSLC, HSC, Transfer Certificate, Provisional Certificate, Convocation Certificate, Degree Certificate, PG Degree Certificate, Mark Sheets, Certificate from the Board or University or from the Institution, as the case may be, with a recording that he had studied the entire duration of the respective course(s) through Tamil medium of instruction from 1<sup>st</sup> standard.



### Certificate for having studied in Tamil Medium @

This is to certify that Thiru / Tmt. / Selvi. ....(Name) had studied..... (Diploma / Degree / PG Degree, etc.) during the year ..... to ..... with Tamil as the medium of instruction and had satisfactorily completed the course of studies prescribed for.....(Diploma / Degree / PG Degree, etc.).

Thiru / Tmt. / Selvi. ....(Name) was / was not awarded scholarship meant for students studying in the Tamil medium.

This certificate is issued with reference to Section 2(d) of the PSTM (Amendment) Act, 2020, based on the verifiable documentary evidence. The undersigned assumes full responsibility for the veracity of the contents herein.

Signature of Principal /  
Registrar Industrial Training Institute /  
College / University

Place:

Date: Seal of the Institution (Mobile No. \_\_\_\_\_)

@ If the candidate has completed different courses in different Institutions, such a certificate shall be obtained from each of these Institutions for the courses completed therein.

### Certificate for direct admission in School

This is to certify that Thiru/Tmt./Selvi/ \_\_\_\_\_(Name) S/o/D/o/Thiru/Tmt./ \_\_\_\_\_ had been admitted directly to \_\_\_\_\_ standard in our School / Institution based on his/her age under the Right to Education Act through direct Admission.

Signature of Principal / Head Master  
(Mobile Number) \_\_\_\_\_

Place: Official Seal of  
Date: School / Institution

4.2.7. If the school name of the candidate has been changed subsequently such candidates should upload the certificate in the following format.

### Certificate for change of school name

This is to certify that Thiru/Tmt/Selvi. \_\_\_\_\_  
S/o/D/o \_\_\_\_\_ studied the classes from \_\_\_\_\_ to \_\_\_\_\_ in  
Tamil Medium during the years from \_\_\_\_\_ to \_\_\_\_\_ in this school.

It is further certified that this school was earlier known as \_\_\_\_\_ and  
consequent to change in the name, this school is presently called as \_\_\_\_\_

This certificate is issued to the above person to claim preferential treatment under section 2 (d) of the  
PSTM (Amendment) Act, 2020.

Place: \_\_\_\_\_

Date: \_\_\_\_\_

Signature with Seal:

Seal of the Institution

Name:  
Designation:  
(Head Master/Principal/  
District Educational Officer/  
Chief Educational Officer)

#### 5. Scheduled Castes, Scheduled Caste (Arunthathiyars) and Scheduled Tribes:

5.1. "Scheduled Castes" means the communities given in the Annexure to the "Instructions to Applicants" [extracted from Part-A of Schedule-II of the Tamil Nadu Government Servants (Conditions of Service) Act, 2016].

5.2. 'Arunthathiyar' means the castes: Arunthathiyar, Chakkiliyan, Madari, Madiga, Pagadai, Thoti and Adi Andhra.

5.3. "Scheduled Tribes" means the communities given in the Annexure to the "Instructions to Applicants" [extracted from Part-B of Schedule-II of Tamil Nadu Government Servants (Conditions of Service) Act, 2016].

Note: Persons belonging to Tamil Nadu and to any one of the communities mentioned in the lists shown in the Annexure to the "Instructions to Applicants" alone shall be treated as Scheduled Castes or Scheduled Tribes as the case may be. Persons belonging to other States shall not be treated as belonging to the Scheduled Castes or Scheduled Tribes even though they may belong to any one of the communities specified in the list.

#### 5.4. Fee Concession: Full exemption

5.5. **Reservation of Appointments:** The selection will be made following the rule of reservation of appointments for Scheduled Castes / Scheduled Caste (Arunthathiyars) / Scheduled Tribes.

Scheduled Caste (SC)	15%
Scheduled Caste (Arunthathiyar) (SCA)	3%
Scheduled Tribe (ST)	1%

## 5.6. Supporting Documents:

5.6.1. The Scheduled Caste (Arunthathiyars) and Scheduled Castes candidates should produce the Community certificate, citing either father's / mother's name, issued by Taluk Tahsildar, in whose jurisdiction the candidate claims to have permanent residence.

5.6.2. The Scheduled Tribe candidates should produce the Community certificate, citing either father's / mother's name, issued by the Revenue Divisional Officer / Assistant Collector / Sub-Collector / Personal Assistant (General) to the Collector of Chennai / District Adi-Dravidar Welfare Officer, in whose jurisdiction the candidate claims to have permanent residence.

5.6.3. Candidates belonging to Scheduled Tribe communities must upload the report of the State Level Scrutiny Committee (SLSC), if available. Failure to do so would render their claim liable to verification by the State Level Scrutiny Committee.

5.6.4. Uploading of a community certificate citing name of the spouse, shall result in rejection of claim after due process.

5.6.5. The certificate obtained by the candidates in the form other than the one referred to in G.O. Ms. No.781, Revenue Department, dated 2nd May 1988 and solely based on the entries in SSLC or Transfer Certificate or other school / college records will not be accepted.

5.6.6. Candidates are warned that if the community recorded in the certificate produced by them from the competent authority is not included in the list of Scheduled Castes, Scheduled Caste (Arunthathiyars), Scheduled Tribes, given in the Annexure to the "Instructions to Applicants" [extracted from the Tamil Nadu Government Servants (Conditions of Service) Act, 2016], they will not be permitted to claim to belong to Scheduled Castes, Scheduled Caste (Arunthathiyars), Scheduled Tribes, as the case may be. They will, in that case, be permitted to claim to belong to 'Others' category only.

5.6.7. Candidates belonging to Scheduled Castes, on conversion to religions other than Christianity / Islam, shall be treated as 'Others'. Candidates belonging to Scheduled Castes, on conversion to Islam shall be treated as "Backward Classes (Muslim). However, Scheduled Caste converts to Sikhism and Buddhism shall be treated as Scheduled Castes.

5.6.8. Failure to upload the supporting documents, when called for shall result in the rejection of claim after due process.

## 6. Backward Classes:

6.1. "Backward Classes" means the communities specified as Backward Classes, Backward Class Muslims, Most Backward Classes / Denotified Communities given in the Annexure to the "Instructions to Applicants" [extracted from Parts A, B, C and D respectively, of Schedule-I of the Tamil Nadu Government Servants (Conditions of Service) Act, 2016].

6.2. Explanation - Persons who belong to the State of Tamil Nadu alone, who belong to one of the communities specified in Schedule-I, of the Tamil Nadu Government Servants (Conditions of Service) Act, 2016 shall be treated as persons who belong to one of such communities.

### 6.3. Fee Concession: Three Free Chances

6.4. **Reservation of Appointments:** The selection will be made following the rule of reservation of appointments for Backward Classes (Muslim), Backward Classes, Most Backward Classes and Denotified Communities.

Backward Class (BC)	26.5%
Backward Class (Muslim) [BC (M)]	3.5%
Most Backward Class / Denotified Communities (MBC / DC)	20.0%

## **6.5. Supporting Documents:**

6.5.1. The candidates belonging to Backward Classes (Muslim), Backward Classes, Most Backward Classes and Denotified Communities should produce the Community certificate, citing either father's / mother's name, issued by Revenue Officer not lower in rank than a Tahsildar or Head Quarters Deputy Tahsildar or Special Deputy Tahsildar appointed to issue Community Certificate or Deputy Tahsildar (School Certificates) or Executive Deputy Tahsildar (in respect of Chennai district) or Additional Head Quarters Deputy Tahsildar or Zonal Deputy Tahsildar, in whose jurisdiction the candidate claims to have permanent residence.

6.5.2. The candidates belonging to Thottia Naicker (including Rajakambalam, Gollavar, Sillavar, Thockalavar, Thozhuvu Naicker, and Erragollar) included in the list of MBC / DC should produce the Community certificate, citing either father's / mother's name, issued by Head Quarters Deputy Tahsildar/ Zonal Deputy Tahsildar, in whose jurisdiction the candidate claims to have permanent residence.

6.5.3. Uploading of a community certificate citing name of the spouse, shall result in rejection of claim after due process.

6.5.4. The certificate obtained by the candidates in the form other than the one referred to in G.O. Ms. No.781, Revenue Department, dated 2nd May 1988 and solely based on the entries in SSLC or Transfer Certificate or other school / college records will not be accepted.

6.5.5. Candidates are warned that if the community recorded in the certificate produced by them from the competent authority is not included in the list of Backward Classes (Muslim), Backward Classes, Most Backward Classes / Denotified Communities, given in the Annexure to "Instructions to Applicants" [extracted from the Tamil Nadu Government Servants (Conditions of Service) Act, 2016], they will not be permitted to claim to belong to Most Backward Classes / Denotified Communities, Backward Classes (other than Muslim) or Backward Classes (Muslim), as the case may be. They will, in that case, be permitted to claim to belong to 'Others' category only.

6.5.6. Candidates belonging to Backward Classes, Most Backward Classes / Denotified Communities on conversion to religions other than Christianity / Islam, shall be treated as 'Others'. Candidates belonging to Backward Classes, Most Backward Classes and Denotified Communities on conversion to Islam shall be treated as "Backward Classes (Muslim)".

6.5.7. Failure to upload the supporting documents, when called for shall result in the rejection of claim after due process.

## **7. Women:**

**7.1. Reservation of Appointments:** A minimum of 30% of all vacancies shall be set apart for women candidates, irrespective of the fact of whether the rule of reservation of appointments applies to the posts or not. In respect of the posts to which the rule of reservation of appointments applies, 30% of vacancies shall be set apart for women candidates, following the reservation for each communal category as well as open category. Women / Transgender (women) candidates shall be entitled to compete for the said 30% of vacancies. They shall also be entitled to compete for the remaining 70% of vacancies along with male / Transgender / Transgender (men) candidates.

**7.2. Supporting Documents:** Gender claimed shall be verified against the Transfer Certificate / Community Certificate. Failure to upload the supporting documents at the time of submission of online application shall result in the rejection of candidature after due process.

## **8. Transgender:**

### **8.1. Supporting Documents:**

8.1.1. Transgender / Transgender (Male) / Transgender (Female) candidates should produce the Transgender ID card issued only by the Tamil Nadu Transgender Welfare Board.

8.1.2. Uploading of Transgender ID card, issued by any authority other than the Tamil Nadu Transgender Welfare Board shall result in rejection of candidature after due process.

8.1.3. Transgender or Transgender (Male) or Transgender (Female) claim made in the online application must correspond to what is stated in the Transgender ID card. Any discrepancy in this regard shall result in rejection of candidature after due process.

8.1.4. Gender claim unsupported by the requisite documents shall result in rejection of claim after due process.

## **8.2. Community:**

8.2.1. Transgender candidates, who do not possess any community certificate may choose to be considered under 'Others' or under Most Backward Classes.

8.2.2. Transgender candidates who belong to Scheduled Caste / Scheduled Caste (Arunthathiyar) / Scheduled Tribe communities and possess community certificate as such, shall be considered as per their respective community.

8.2.3. Transgender candidates who belong to communities other than Scheduled Caste / Scheduled Caste (Arunthathiyar) / Scheduled Tribe and possess community certificate as such, are permitted to choose to be considered as belonging to their own community or as Most Backward Class, whichever is advantageous to them, at the time of One Time Registration itself. Once the individual opts to be considered as a particular community, it shall be crystallized and this option shall not be changed in the future.

8.2.4. Transgender candidates who do not possess a community certificate and have chosen to be considered under 'Most Backward Classes' or 'Others' and those in possession of a community certificate as Backward Classes / Backward Classes (Muslim) / Denotified Communities but have chosen to be considered under 'Most Backward Classes', need not upload a community certificate in support of their claim.

8.2.5. Transgender candidates, in possession of a community certificate and who have chosen to be considered under the communal reservation category as stated in the community certificate, must upload the same. Failure to upload such a certificate shall result in rejection of claim after due process.

8.2.6. All concessions permitted to Transgender candidates in the matter of choice of communal reservation category, shall be wholly dependent on the uploading of a Transgender ID card issued by the Tamil Nadu Transgender Welfare Board. Failure to upload the same or uploading of a Transgender ID card issued by other authorities, shall result in rejection of claim after due process.

### Annexure III

#### Syllabus

#### Paper I

### Tamil Eligibility Test, General Studies, Aptitude and Mental Ability

#### Part A - தமிழ் மொழி தகுதித் தேர்வு (பத்தாம் வகுப்பு தரம்)

Code: 503

#### அலகு I: இலக்கணம் (25 கேள்விகள்)

எழுத்து: பிரித்து எழுதுதல் - சேர்த்து எழுதுதல் - சந்திப்பிழை - குறில், நெடில் வேறுபாடு - லகர, ளகர, ழகர வேறுபாடு - னகர, ணகர வேறுபாடு - ரகர, றகர வேறுபாடு - இனவெழுத்துகள் அறிதல் - கூட்டு எழுத்துகள் - வினா எழுத்துகள் - ஒருமைப் பன்மை அறிதல்.

சொல்: வேர்ச்சொல் அறிதல் - வேர்ச்சொல்லில் இருந்து வினைமுற்று, வினையெச்சம், வினையாலணையும் பெயர், பெயரெச்சம் வகை அறிதல் - அயற்சொல் தமிழ்ச்சொல், எதிர்ச்சொல் வினைச்சொல் - எழுத்துப் பிழை, ஒற்றுப்பிழை அறிதல் - இரண்டு வினைச் சொற்களின் வேறுபாடு அறிதல்.

#### அலகு II: சொல்லகராதி (15 கேள்விகள்)

(i) எதிர்ச்சொல்லை எடுத்தெழுதுதல், ஓரெழுத்து ஒரு மொழி, உரிய பொருளைக் கண்டறிதல் - ஒருபொருள் தரும் பல சொற்கள், பொருந்தா சொல்லைக் கண்டறிதல், அகர வரிசைப்படி சொற்களைச் சீர்செய்தல்; ஒருபொருள் பன்மொழி - இருபொருள் குறிக்கும் சொற்கள் - பேச்சு வழக்கு, எழுத்து வழக்கு - சொல்லும் பொருளும் அறிதல் - ஒரு சொல்லிற்கு இணையான வேறு சொல் அறிதல்.

(ii) கோடிட்ட இடத்தில் சரியான சொல்லைத் தேர்ந்தெடுத்து எழுதுதல் - (எ.கா.) பள்ளிக்குச் சென்று கல்வி பயிலுதல் சிறப்பு (பயிலுதல், எழுதுதல்) - வாணில் முகில் தோன்றினால் மழை பொழியும் (முகில், நட்சத்திரம்); பொருத்தமான பொருளைத் தெரிவு செய்தல் - (எ.கா.) ஊடகம் - தகவல் தொடர்புச் சாதனம் (செய்தி, தகவல் தொடர்புச் சாதனம்) - சமூகம் - மக்கள் குழு (மக்கள் குழு கூட்டம்); ஊர்ப் பெயர்களின் மருஉவை எழுதுக - (எ.கா) புதுச்சேரி - புதுவை, மன்னார்குடி - மண்ணை, மயிலாப்பூர் - மயிலை; பிழை திருத்துக (எ.கா) ஒரு - ஓர் பேச்சு வழக்குச் சொற்களுக்கு இணையான தூய தமிழ்ச் சொற்களை இணைத்தல் - (எ.கா) வெத்தில - வெற்றிலை, நாக்காலி நாற்காலி.

(iii) பேச்சு வழக்குத் தொடர்களிலுள்ள பிழை திருத்தம் - (எ.கா.) நேத்து மழ பேஞ்சது - நேற்று மழை பெய்தது; சொற்களை இணைத்துப் புதிய சொல் உருவாக்குதல்: மற்றும், அல்லது. ஆல், பிறகு வரை, இதுவுமல்ல, இருப்பினும், எனினும், இதனால்; அடைப்புக்குள் உள்ள சொல்லைத் தகுந்த இடத்தில் சேர்த்தல் - (எனவே, ஏனெனில், ஆகையால், அதுபோல, அதனால், வரை, பின்பு) - (எ.கா) நான் காட்டிற்குச் சென்றேன். அதனால் புலியைப் பார்த்தேன் - மாலைநேரம் முடியும் வரை விளையாடுவேன். தேர்வு முடிந்த பின்பு சுற்றுலா செல்லலாம்; பொருள் தரும் ஓர் எழுத்து - (எ.கா) ஆ-பசு, ஈ-கொடு, தை-மாதம், தீ-நெருப்பு; பல பொருள் தரும் ஒரு சொல்லைக் கூறுக - (எ.கா) கமலம், கஞ்சம், முளரி, பங்கயம் இச்சொற்கள் தாமரையைக் குறிக்கும்.

#### அலகு III: எழுதும் திறன் (15 கேள்விகள்)

(i) சொற்களை ஒழுங்குபடுத்திச் சொற்றொடர் அமைத்தல் - தொடர் வகைகள் - செய்வினை, செயப்பாட்டு வினை - தன்வினை, பிறவினை - ஒருமைப் பன்மை பிழையறிந்து சரியான தொடரறிதல்.

(ii) மரபுத் தமிழ்: திணை மரபு - உயர்திணை: அம்மா வந்தது - அம்மா வந்தாள்: அஃறிணை: மாடுகள் நனைந்தது - மாடுகள் நனைந்தன; பால் மரபு: ஆண்பால்: அவன் வந்தது - அவன் வந்தான்; பெண்பால்: அவள் வந்தது - அவள் வந்தாள்; பலர் பால்: அவர்கள் வந்தார்கள் - அவர்கள் வந்தனர்; ஒன்றன் பால்: அது வந்தது - அது வந்தது; பலவின் பால்: பறவைகள் பறந்தனர் - பறவைகள் பறந்தன; காலம்: நேற்று மழை பெய்யும் - நேற்று மழை பெய்தது; நேற்று வருவேன் - நேற்று வந்தேன்; இளமைப் பெயர்: பசு - கன்று; ஆடு - குட்டி; ஒலிமரபு: நாய் கத்தியது - நாய் குரைத்தது; வினைமரபு: கூடைமுடை, சோறு உண்; தொகை மரபு: மக்கள் கூட்டம் - ஆட்டு மந்தை, நிறுத்தல் குறியீடுகள்: கால்புள்ளி, அரைப் புள்ளி, முக்கால் புள்ளி, முற்றுப் புள்ளி, வியப்புக் குறி, வினாக்குறி அமையும் இடங்கள்.

#### **அலகு IV: கலைச் சொற்கள் (10 கேள்விகள்)**

பல்துறை சார்ந்த கலைச் சொற்களை அதாவது அறிவியல், கல்வி, மருத்துவம், மேலாண்மை, சட்டம், புவியியல், தொழில்நுட்பம், ஊடகம், தகவல் தொழில்நுட்பம் உள்ளிட்ட பல்துறை சார்ந்த கலைச் சொல்லுக்கு நேரான தமிழ்ச் சொற்களை அறிந்திருக்க வேண்டும். (உதாரணம்: search engine – தேடு பொறி, வலசை – Migration, ஒவ்வாமை – Allergy, மரபணு – Gene, கடல் மைல் – Nautical Mile).

#### **அலகு V: வாசித்தல் – புரிந்து கொள்ளும் திறன் (15 கேள்விகள்)**

கொடுக்கப்பட்ட பத்தியிலிருந்து கேட்கப்பட்ட வினாக்களுக்கு சரியான விடையைத் தேர்ந்தெடுத்தல் – செய்தித்தாள் – தலையங்கம் – முகப்புச் செய்திகள் – அரசு சார்ந்த செய்திகள் – கட்டுரைகள் – இவற்றை வாசித்தல் – புரிந்து கொள்ளும் திறன் – உவமைத் தொடரின் பொருளறிதல் – மரபுத் தொடரின் பொருளறிதல் – பழமொழிகள் பொருளறிதல் – ஆவண உள்ளடக்கங்களைப் புரிந்து கொள்ளும் திறன்.

#### **அலகு VI: எளிய மொழி பெயர்ப்பு (5 கேள்விகள்)**

ஆங்கிலம் மற்றும் பிறமொழிச் சொற்களுக்கு இணையான தமிழ்ச் சொற்கள் அறிதல் வேண்டும் – பயன்பாட்டில் உள்ள ஆங்கிலச் சொற்களை மொழிபெயர்த்தல் வேண்டும் (சான்று: pendrive, printer, computer, keyboard) – ஆவணங்களின் தலைப்பு – கோப்புகள் – கடிதங்கள் – மனுக்கள் – மொழிபெயர்ப்பு புரிந்து கொள்ளுதல்.

#### **அலகு VII: இலக்கியம், தமிழ் அறிஞர்களும், தமிழ்த்தொண்டும் (15 கேள்விகள்)**

திருக்குறள் தொடர்பான செய்திகள் (இருபது அதிகாரங்கள் மட்டும்) ஒழுக்கமுடைமை, பொறையுடைமை, ஊக்கமுடைமை, விருந்தோம்பல், அறன் வலியுறுத்தல், ஈகை, பெரியாரைத் துணைக்கோடல், வினை செயல்வகை, அவையஞ்சாமை, கண்ணோட்டம், அன்புடைமை, கல்வி, நடுநிலைமை, கூடா ஒழுக்கம், கல்லாமை, செங்கோன்மை, பண்புடைமை, நட்பாராய்தல், புறங்கூறாமை, அருளுடைமை – மேற்கோள்கள் – அறநூல் தொடர்பான செய்திகள் (நாலடியார், நான்மணிக்கடிகை, பழமொழி நானூறு, முதுமொழிக்காஞ்சி, திரிகடுகம், இன்னாநாற்பது, சிறுபஞ்சமூலம், ஏலாதி, அவ்வையார் பாடல்கள்) – தமிழின் தொன்மை, சிறப்பு, திராவிட மொழிகள் தொடர்பான செய்திகள் – உ.வே.சாமிநாத ஐயர், தெ.பொ.மீனாட்சி சுந்தரம். சி.இலக்குவணார் தமிழ்ப்பணி தொடர்பான செய்திகள் – தேவநேய பாவாணர், அகரமுதலி, பாவலரேறு பெருஞ்சித்திரனார், ஜி.யு போப், வீரமாமுனிவர் தமிழ்த் தொண்டு தொடர்பான செய்திகள் – தமிழ்ச் சான்றோர் பற்றிய செய்திகள்: பாவேந்தர், டி.கே.சிதம்பரனாதர், தவத்திரு குன்றக்குடி அடிகளார், கண்ணதாசன், காயிதே மில்லத், தாரா பாரதி, வேலுநாச்சியார், பட்டுக்கோட்டைக் கல்யாணசுந்தரம், முடியரசன், தமிழ் ஒளி உருத்திரங்கண்ணனார், கி.வா.ஜகந்தாதர், நாமக்கல் கவிஞர்.

### **PART B: General Studies (Degree Standard)**

#### **UNIT I: General Science (5 Questions)**

Scientific knowledge and scientific temper - Power of reasoning - Rote learning vs conceptual learning - Science as a tool to understand the past, present, and future; Nature of universe - General scientific laws – Mechanics - Properties of matter, force, motion, and energy - Everyday application of the basic principles of mechanics, electricity and magnetism, light, sound, heat, nuclear physics, laser, electronics, and communications; Elements and compounds, acids, bases, salts, petroleum products, fertilizers, pesticides; Main concepts of life science, classification of living organisms, evolution, genetics, physiology, nutrition, health and hygiene, human diseases; Environment and ecology; Latest inventions in science and technology; Current affairs.

#### **UNIT II: Geography of India (5 Questions)**

Location - Physical features - Monsoon, rainfall, weather and climate - Water resources - Rivers in India - Soil, Minerals and Natural Resources - Forest and Wildlife - Agricultural pattern; Transport – Communication; Social Geography – Population density and distribution - Racial, linguistic groups and major tribes; Natural calamity - Disaster management; Environmental pollution - Reasons and preventive measures - Climate change - Green energy; Geographical landmarks; Current affairs.

### **UNIT III: History, Culture of India, and Indian National Movement (10 Questions)**

Indus Valley Civilization - Guptas, Delhi Sultans, Mughals, and Marathas - Age of Vijayanagaram and Bahmani Kingdoms - South Indian History; National Renaissance - Early uprising against British rule - Indian National Congress - Emergence of leaders – B.R.Ambedkar, Bhagat Singh, Bharathiar, V.O.Chidambaranar, Jawaharlal Nehru, Kamarajar, Mahatma Gandhi, Maulana Abul Kalam Azad, Thanthai Periyar, Rajaji, Subash Chandra Bose, Rabindranath Tagore, and others; Different modes of agitation: Growth of Satyagraha and Militant Movements; Communalism and Partition; Change and continuity in the socio-cultural history of India; Characteristics of Indian Culture, Unity in Diversity – Race, Language, Custom; India as a secular state, Social harmony; Prominent personalities in various spheres – Arts, Science, Literature and Philosophy.

### **UNIT IV: Indian Polity (15 Questions)**

Constitution of India - Preamble to the Constitution - Salient features of the Constitution - Union, State and Union Territory - Citizenship, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy - Union Executive, Union Legislature - State Executive, State Legislature - Local Governments, Panchayat Raj - Spirit of federalism: Centre - State relationships - Election - Judiciary in India – Rule of Law - Corruption in public life – Anti-corruption measures - Lokpal and Lok Ayukta - Right to Information - Empowerment of Women - Consumer Protection Forums, Human Rights Charter; Political parties and political system in India; Current affairs.

### **UNIT V: Indian Economy and Development Administration in Tamil Nadu (20 Questions)**

Nature of Indian Economy – Five-year plan models - an assessment - Planning Commission and Niti Aayog; Sources of revenue - Reserve Bank of India - Fiscal Policy and Monetary Policy - Finance Commission - Resource sharing between Union and State Governments - Goods and Services Tax; Structure of Indian Economy and Employment Generation, Land Reforms and Agriculture - Application of Science and Technology in Agriculture - Industrial growth - Rural welfare oriented programmes - Social problems - Population, Education, Health, Employment, Poverty; Human Development Indicators in Tamil Nadu and a comparative assessment across the Country – Impact of social reform movements in the socio-economic development of Tamil Nadu - Political parties, and welfare schemes for various sections of people - Rationale behind the reservation policy, and access to the social resources - Economic trends in Tamil Nadu - Role and impact of social welfare schemes in the socio-economic development of Tamil Nadu - Social Justice and social harmony as the cornerstones of socio-economic development; Education and health systems in Tamil Nadu; Geography of Tamil Nadu and its impact on economic growth; Achievements of Tamil Nadu in various fields; e-Governance in Tamil Nadu; Public awareness and General administration - Welfare oriented Government schemes and their utility, Problems in public delivery systems; Current socio-economic issues; Current affairs.

### **UNIT VI: History, Culture, Heritage, and Socio-Political Movements in Tamil Nadu (20 Questions)**

History of Tamil Society, related archaeological discoveries, Tamil literature from Sangam age till contemporary times - Thirukkural - Significance as a secular literature - Relevance to everyday life, Impact of Thirukkural on humanity, Thirukkural and universal values - Relevance to Socio-politicoeconomic affairs, Philosophical content in Thirukkural; Role of Tamil Nadu in freedom struggle - Early agitations against British Rule - Role of women in freedom struggle; Evolution of 19th and 20th century socio-political movements in Tamil Nadu - Justice Party, Growth of Rationalism - Self Respect Movement, Dravidian Movement, and principles underlying both these movements; Contributions of Thanthai Periyar and Perarignar Anna.

## **PART C: Aptitude and Mental Ability (SSLC STANDARD)**

### **UNIT I: Aptitude (15 Questions)**

Simplification - Percentage - Highest Common Factor (HCF) - Lowest Common Multiple (LCM) - Ratio and Proportion - Simple interest - Compound interest - Area - Volume - Time and Work.

### **UNIT II: Reasoning (10 Questions)**

Logical reasoning - Puzzles - Dice - Visual reasoning - Alpha numeric reasoning - Number series.

## Paper II

### 1. Agricultural, Mechanical, Automobile and Civil Engineering (Degree Standard)

Code: 562

#### Unit I: General Engineering (20 Questions)

Statics of Particles, Equilibrium of Rigid bodies, Properties of Surfaces and Solids, Centroid, Centre of Gravity, Dynamics of Particles, Friction in Machine Elements, Stress, Strain and Deformation of Solids, Theories of Failures, Design of Shafts and Couplings, Fluid statics, equations of continuity and momentum, Bernoulli's equation, Flow through pipes, head losses in pipes, bends, Pumps and its applications, Valves and Types, Iron Carbide Phase Diagram, ferrous and nonferrous alloys, Heat treatment of ferrous and non-ferrous metal, Engineering and commodity polymers, composites, nano-materials, Foundry Technology- Metal Forming Processes, Metal Joining processes, Manufacturing of Thermo Setting and Thermo Plastic Products, Inventory control - Economic Order Quantity (EOQ) - quantity discounts, ABC Analysis, Operations Research, Assignment Model, Critical Path Method (CPM) and Program Evaluation Review Technique (PERT), Queuing Models, Industrial Safety.

#### Unit II: Surveying and Hydrology (20 Questions)

Surveying – Instruments - Methods of surveying – Linear measurements - Computation of area – Triangulation, intersection, traversing, cross staff survey – Plane table survey – Earth work computation - Simpson's and trapezoidal rule - Levelling - Definition - Types of benchmarks - Different types of levels – Reduced level by rise and fall method and height of collimation method - Contouring – Profile surveying - Cross section survey - Use of Minor instruments - Theodolite survey - Total station - GPS survey. Hydrology – Measurement of rainfall, evaporation and infiltration – Estimation of runoff – Factors affecting runoff – Computation of volume of runoff and peak flow – Unit hydrograph - Occurrence and movement of ground water - ground water exploration techniques - hydraulics of wells, types of wells and their construction - Well drilling – Methods and machinery - Techniques for different formations - Well logging - Types of well screen - Design of well screens - Well development - Yield testing.

#### Unit III: Soil Erosion and Conservation (15 Questions)

Soil erosion – Types – Factors affecting erosion by water and wind - Stages of water erosion - Biological control measures and their suitability - Contour farming, strip cropping, mixed cropping, intercropping and mulching - Mechanical control measures and their suitability – Design and construction of contour bunds, graded bunds, terraces, contour stone walls, contour trenches, staggered trenches and diversion drain - Gully control structures - Drop spillway, chute spillway, pipe inlet spill way and check dams - Wind erosion – Types and control - Wind breaks and shelter belts - Dry farming techniques for improving crop production - Estimation of soil erosion - Universal Soil Loss Equation.

#### Unit IV: Watershed Development and Management (15 Questions)

Watershed – Concept, types and delineation - Land capability classification - Participatory Rural Appraisal Technique – Watershed development plan – Estimation of cost and benefits -Gully and ravine reclamation – In-situ & Ex-situ water harvesting, micro catchments – Ground water recharge - Artificial recharge techniques and methods - Farm pond and percolation pond – Selection of suitable soil and water conservation practices – Afforestation – Holistic planning - Watershed based rural development – Use of aerial photography and remote sensing in watershed management - Applications of Remote sensing and GIS in planning and development of watersheds including forest cover and water resources.

#### Unit V: Farm Irrigation, Structures and Drainage (30 Questions)

Irrigation - Sources – Soil- water- Plant relationship - Water requirement of crops – Measurement of irrigation water - Weirs and flumes - Methods of irrigation - Surface, Sprinkler, Rain gun and drip irrigation - Irrigation automation - Drip irrigation – Components and design - Wetting pattern - Filters and Fertigation tanks - Pump capacity - Operation and maintenance - Sprinkler irrigation - Components - Sprinkler performance - Hydraulic design of sprinkler systems - Duty and delta relationship – Irrigation scheduling - Irrigation efficiencies and their estimation - Pumps - Types, selection and installation - Design and construction of farm structures – Site selection – Quality – RCC - Foundation, basement and

superstructure – Types of roofs – building plan and estimation, requirements of farm house, threshing floor, drying floor, poultry house, dairy farm, rat proof go down and farm roads - Design features earthen dams and gravity dams - Water conveyance structures – Earthen channels and lined channels – Advantages of lining – materials of lining – Design of channel cross section – Crossing control structures – Road crossing structures – Culvert, inverted siphon aqueduct – Their uses - Underground pipe line system – Components and their functions – Structures for plant environment – Green houses, poly houses and shade nets – Construction and utilization - Soilless culture. Drainage - Causes of water logging and salt problem - Methods of drainage - Design of surface, sub-surface and vertical drainage systems - Improvement and utilization of poor quality water - Reclamation of saline and alkali soils.

#### **Unit VI: Farm Power (20 Questions)**

Sources of Farm Power- Construction and working of Spark Ignition (SI) and Compression Ignition (CI) engines- Thermodynamic principles of SI and CI engine - Two stroke and Four stroke engines - Turbo charging – Fuel injection systems, Ignition, Lubrication and Cooling systems, Speed governors, Electrical systems of Internal Combustion engines - Different types of tractors, bull dozers and power tillers - power transmission systems, Types of Clutches and Gearboxes, Differential, Final drive system, Braking system – types, constructional details and operation, Steering system - – types, constructional details and operation, Suspension system – types, constructional details, uses of hydraulic system in tractors, hitching system, three point linkage- tractor power outlets. Resistances to vehicle motion, vehicle performance characteristics, Operations using bull dozer, Types of wheels and tyres – Battery: types, constructional details and working principle. Tractor stability - mechanics of tractor implement combination, weight transfer - Ergonomic considerations in operation of tractors, Safety devices in tractors, Maintenance of tractors. Single phase induction motor - three phase power measurement methods- Power factor- Electrical pump sets - regulated DC power supply, DC machine, DC generator, DC motor, starter - torque and efficiency - Electronics in Agriculture - Semi -conductors, transistors, operational amplifiers – Digital electronics, counters, encoders, decoders, Digital to Analog and Analog to digital converter-Instrumentation - transducers - strain gauges, types and gauge factor - force measurement using strain gauges, Torque measurement, pressure measurement, flow measurement temperature measurement, thermocouples, speed measurement microprocessors, microcontrollers, PID controllers, PLC - Electric vehicles in Agriculture.

#### **Unit VII: Farm Machinery (20 Questions)**

Earth moving equipment - Back hoe with front end loader, Crawler excavator - Bull dozer - blades-shovels-soil digging machines-primary tillage implements-indigenous plough, Mould board plough, disc plough, chisel plough, sub soiler, methods of ploughing – secondary tillage implements-cultivators, harrows, rotary tillers, rotavator, land shaping machinery- laser leveller, ridger, bund former, raised bed former, puddler. Calculation of field capacity, field efficiency. Sowing and transplanting –seed drills, types - different types of metering mechanisms, planters, broadcasters and rice transplanters, pneumatic planters- intercultural implements - dryland weeders, wetland weeders, manual and power operated weeders - plant protection equipments – sprayers - types of sprayers - Drone sprayer - calibration of sprayer, types of nozzles, drift – harvesters - sickle, mower, cutter bar, reaper, binders, windrowers - threshers - principle of threshing, types of threshers, threshing drums, calculation of output capacity, combines, working principles, components of combine. Root crop harvesters, cotton harvesters, cotton strippers, sugarcane harvester, maize harvesters, vegetable and fruit harvesters, crop residue management machinery - cost estimation of farm machinery.

#### **Unit VIII: Unit Operations in Food and Agricultural Processing (20 Questions)**

Heat transfer principles – Conduction, convection and radiation - Types of heat exchangers - Unit operations – Evaporators - Types - Mechanical separation – Filtration – Sedimentation – Settling – Centrifugal separation – Cyclone separation - Size reduction – Mixing – Blending – emulsification - Food processing operations - Pasteurization – Sterilization – Canning - Retort processing - Extrusion processing of foods - Methods of drying of foods – Preservation of food by irradiation - Microwave and dielectric heating - Fats and oil processing – Extraction methods and equipment - Food packaging – Materials and characteristics – Suitability - Processing of milk and milk products, packaging of milk - Principles of refrigeration and applications in food industries – Cold storage of fruits and vegetables - Design aspects

### **Unit IX: Process Engineering of Agricultural and Horticultural crops (20 Questions)**

Engineering properties of food materials – Moisture content – Methods of determination – Psychrometry - Drying – Thin layer and deep bed drying – Types of heat sources and types of dryers - Cleaning and grading – Principles – Separators – Efficiency – Performance index - Shelling and decortication – Seed processing and layout of seed processing units - Rice processing – Parboiling and dehusking of paddy – Machines used - Milling of corn, pulses and millets - Material handling equipments - Conveyors and elevators - Storage – Conditions for safe storage – Bag and bulk storage – Silo storage - Design aspects - Modified atmosphere storage – Storage structures - Equipment used for processing of horticultural crops – Preservation of fresh fruits and vegetables – Drying and dehydration – Processing of coffee, tea, rubber, cashew nut, coconut, oil palm, aromatic plants, flowers and spices.

### **Unit X: Renewable and Bioenergy (20 Questions)**

Solar energy – Solar collectors – Air heaters - Solar dryers – Water heaters - Solar cold storage– Solar photovoltaic systems and applications- Solar PV pump, fencing - Wind energy - Suitable sites – Types of wind mills – Wind mill components – Applications – Performance of wind mills - Biomass resources – Agro residues – Characteristics - Conversion technologies – Biochemical conversion – Biogas plant – Types and selection, construction, operation and maintenance - Slurry handling - Thermochemical conversion – Stoves – Types - Improved stoves – Pyrolysis – Charcoal production – Gasification – Briquetting – Alternate renewable energy systems - Hydro power, Geothermal, ocean and hydrogen energy- Energy storage systems- Energy Conservation- Cogeneration - Energy plantation and environmental impact – Global warming – Clean development mechanism (CDM) and role of afforestation - Biofuels – Biodiesel feedstock, production and by-product utilization – Ethanol – Production and utilization – Emission - Standards and control.

## **2. Agriculture (Degree Standard)**

**Code: 491**

### **Unit I: Importance of Agriculture (10 Questions)**

Importance of Agriculture in Indian Economy and its sectoral relationship - Agricultural Development through five year plans in India and Tamil Nadu - Growth pattern of crops in India and Tamil Nadu in terms of area, production and productivity - Government Agricultural Policies – Agricultural development through NITI AAYOG – import and export – role of NSC, FCI and PDS - Sustainable Developmental Goals.

### **Unit II: Fundamentals of Crop Production (20 Questions)**

Factors of Production - Agricultural seasons of India and Tamil Nadu - Cropping patterns in India and Tamil Nadu - package of practices of different crops – Agro-Climatic zones of India and Tamil Nadu and their features - Weather and Climate - Weather forecasting – Remote sensing and GIS application - Climate change and its impact – Minimal tillage practices – Stress mitigating technologies including microorganisms – Nanoparticles and their applications – Natural farming and Bio-inoculants – Organic certification and standards – Drone technology in Agriculture.

### **Unit III: Natural Resource Management (20 Questions)**

Soil - Soil structure - Factors influencing soil structure - Physical and Chemical properties - Effect of nutrient availability and plant growth – Soil health - Problem soils and their management - Soil survey - its objectives and scope - Soil fertility and productivity – Soil testing – Chemistry of Macro and Micro Nutrient – Soil health - Integrated Nutrient Management - Dry farming - Rainfed agriculture - Conservation of soil and water - Watershed and waste land development. Land use pattern and planning - Size and distribution of holdings - types and systems of farming - Water resources development and management - Command area development - Ground water Development and Conjunctive use - Water use efficiency - Quality of irrigation water - Its effect in soil and crops - Management of poor quality water for crop growth.

### **Unit IV: Crop Management & Allied Agricultural Activities (24 Questions)**

Cropping systems and integrated farming - Recycling of agricultural waste - Organic manures, green manures, bio fertilizers - Balanced usage - integrated nutrient management - Physiological disorders in

crop plants and their management - Plant growth regulators – Regulation of flowering – Classification of stresses – Physiological adaptation of crop plants for abiotic stress - Irrigation management of different crops, Mushroom cultivation, bee keeping, silkworm rearing etc., Energy in Agricultural production - Sources - Solar, wind, animal, biomass and biogas - Mechanization in agriculture - Tractors & tillers - Agricultural implements and Machineries and their usage - livestock and poultry rearing.

#### **Unit V: Crop Improvement (26 Questions)**

Principles of breeding - Breeding methods in self, cross and vegetatively propagated crops - Modern tools in crop improvement – Heterosis breeding and Hybrid seed production technologies – Synthetic and composites – Breeding for biotic, abiotic and quality traits. Latest varieties of major crops in Tamil Nadu – Variety release procedures - Application of bio technology in Agriculture - Tissue culture & its significance - Transgenic Plants - Marker assisted selection – Markers - mapping population - speed breeding - Plant Genetic Resources: Collection conservation and exchange-Crop varietal protection-PPV& FR authority and its role.

#### **Unit VI: Seed Science and Technology (20 Questions)**

Seeds - Importance of quality seeds in Agriculture – Nucleus, Breeder, foundation, certified and labelled seeds – Characterisation of good quality seeds - Seed certification techniques and processing in Tamil Nadu - Seed testing – Seed testing laboratories-ISTA standards for seed testing - seed village concept Seed Act - Seed coating and priming technologies - Seed enhancement technologies – Varietal deterioration of crops – causes and maintenance – Post harvest handling of seeds.

#### **Unit VII: Crop Protection Principles and Practices (24 Questions)**

Importance of pest, disease, nematodes and weed management in agriculture – categories of pests, diseases, nematodes and weeds - pest and disease surveillance and weather forecasting on pest and disease incidence - Symptoms of damages, biology and control measures of pest, disease and nematodes of major crops in Tamil Nadu - Integrated pest, disease and nematode management in crop production - Pesticides and their use in IPM – mode of action - Pattern - plant protection equipments and their use - Plant quarantine - Storage pests, disease and nematodes and their management - Importance of biological control in pest, disease and nematode management - Weeds - Major weeds and their control – Pollinators and their safety – Banned and Next generation agro-chemicals.

#### **Unit VIII: Farm Business and Finance Management (20 Questions)**

Farm business management - Principles of farm business management – Types and systems of farms-Classical Production Functions - Cost concepts - Management of resources - Farm Planning and budgeting - Investment analysis – Risk and uncertainties in Agriculture - Agricultural credit system in India - Multi credit delivery system - Role of nationalized banks, NABARD and Regional Rural Banks - Lead Bank Scheme - Service area approach - Scale of finance-Credit Worthiness-3Rs,5Cs and 7Ps of credit-Crop Insurance - Kisan Credit Cards (KCC) - Agricultural Insurance Company.

#### **Unit IX: Agricultural Marketing and Market Intelligence (20 Questions)**

Marketing - Agricultural marketing - Market structure – Marketing Efficiency - Price Spread-Market Integration-Market Risk-Speculation and hedging - Market Institutions- Warehouses and rural godowns - Agmark-Cooperatives - Commodity Boards – Agri business management – Farmer Producer Organisations and Agri-business incubation - Principles of Management-Entrepreneurship - Development - Forms of Business organizations - Agricultural Price Policy - CACPMSP - FRP- Procurement Price-Policies for agricultural development - Economic liberalization - WTO and its impact on agricultural export - IPR – APEDA – International trading in agricultural commodities - Importance of Agriculture in Indian economy - Land size and distribution of holdings and land use pattern in Tamil Nadu - Agriculture under Five Year Plans (FYPs) - Food Security - Public Distribution Systems (PDS) - Buffer Stock.

#### **Unit X: Agricultural Extension: Principles and Methods (16 Questions)**

Extension methods for transfer of technology - AV aids-Communication models - Use of ICT in transfer of technology-Diffusion and adoption- Pre and post independent rural development initiatives: key features, strength and weakness of individual programmes - Programme planning and evaluation methods- Rural sociology - key features of Indian rural system-value system-social change- rural migration. Role of women

in Agriculture – Social organisations and Non-Governmental organisations – Extensions / Agricultural Developmental programs by ICAR / Government – e-Agriculture and Digital Tools.

### **3. Agriculture, Chemistry, Zoology and Botany (Degree Standard)**

**Code: 518**

#### **Unit I: Agriculture and Its Principles (20 Questions)**

Area, production and productivity of crops in India and Tamil Nadu - Government Agricultural Policies – Role of NSC, FCI and PDS - Agricultural seasons, cropping patterns and agro climatic zones of India and Tamil Nadu – Package of practices of different crops – Classification of stress and mitigating technologies - Nanoparticles and their applications – Natural farming - Organic certification and standards – Drone technology in Agriculture. Soil health - Problem soils and their management - Soil survey - Its objectives and scope – Soil fertility and productivity – Soil testing – Integrated Nutrient Management. Quality of irrigation water - Its effect in soil and crops – Chemistry of Macro and Micro Nutrient - Physiological disorders in crop plants and their management – Energy in Agricultural production - Sources-Solar, wind, animal, biomass and biogas – Agricultural implements and Machineries and their usage.

#### **Unit II: Crop Improvement (25 Questions)**

Principles of breeding - Breeding methods in self, cross and vegetatively propagated crops - Modern tools in crop improvement – Heterosis breeding and Hybrid seed production technologies – Synthetic and composites – Breeding for biotic, abiotic and quality traits. Latest varieties of major crops in Tamil Nadu – Variety release procedures - Application of biotechnology in Agriculture - Tissue culture & its significance – Transgenic Plants - Marker assisted selection – Markers - Plant Genetic Resources Collection conservation and exchange – Crop varietal protection - PPV& FR authority and its role. Seeds – Importance of quality seeds in Agriculture – Nucleus, Breeder, foundation, certified and labeled seeds – Characterisation of good quality seeds – Seed certification techniques and processing in Tamil Nadu - Seed testing – Seed testing laboratories - ISTA standards for seed testing - seed village concept. Seed Act - Seed coating and priming technologies – Seed enhancement technologies – Varietal deterioration of crops – causes and maintenance – Post harvest handling of seeds.

#### **Unit III: Crop Protection Principles and Practices (25 Questions)**

Importance of pest, disease, nematodes and weed management in agriculture – categories of pests, diseases, nematodes and weeds - Migratory pests – Pest and disease surveillance and weather forecasting on pest and disease incidence - Symptoms of damages, biology and control measures of pest, disease and nematodes of major crops in Tamil Nadu - Integrated pest, disease and nematode management in crop production - Pesticides and their use in IPM – mode of action – plant protection equipments and their use – Plant quarantine - Storage pests, disease and nematodes and their management - Importance of biological control in pest, disease and nematode management – Weeds - Major weeds and their control – Pollinators and their safety – Banned and next generation agro chemicals - Fumigation methods - Insecticide residue and MRL.

#### **Unit IV: Farm Business Management and Economics (20 Questions)**

Farm business management - Cost concepts - Management of resources - Farm Planning and budgeting - Investment analysis – Risk and uncertainties in Agriculture - Agricultural credit system in India - Multi credit delivery system - Role of nationalized banks, NABARD and Regional Rural Banks - Crop Insurance - Kisan Credit Cards (KCC) – Agricultural marketing – Market structure – Marketing Efficiency - Market Risk - Speculation and hedging - Market Institutions - Warehouses and rural godowns – Agmark - Cooperatives - Commodity Boards – Agri business management – Farmer Producer Organisations and Agri-business incubation - Agricultural Price Policy - CACPMS - FRP - Procurement Price - Policies for agricultural development – International trading in agricultural commodities - Food Security - Public Distribution Systems (PDS) - Buffer Stock - Extension methods for transfer of technology – AV aids – Communication methods - Rural sociology - Social organisations and Non-Governmental organisations – Developmental programs by ICAR / Government – e-Agriculture and Digital Tools.

#### **Unit V: Analytical Chemistry and Fertilizers (20 Questions)**

Preparation of standard solutions – Indicators, Buffer solutions, Molarity, Normality – Principles of Volumetric Analysis - Different types of titrations – Gravimetric Analysis – Basic principles and instrumentation of column, TLC, Gas Chromatography and HPLC.

Preparation, properties and uses: Urea, Ammonium Nitrate – Calcium ammonium nitrate, ammonium phosphate and super phosphate

#### **Unit VI: Carbohydrates and Amino Acids (15 Questions)**

Carbohydrates: Classification, Sources, Preparation and reactions – Glucose, Fructose, Sucrose and lactose – Structure of glucose and fructose.

Amino Acids: Classification – Zwitter ion – peptide linkage – Structure of proteins

#### **Unit VII: Systematic Botany (20 Questions)**

General features, structure, reproduction and economic importance of Algae, Bryophytes, Pteridophytes and Gymnosperms. General characters, occurrence, mode of nutrition and reproduction of fungi. Harmful effects of fungi on plants. General symptoms and control measures of viral, bacterial and fungal diseases. Whittaker's five kingdom classification. Koch postulates. Disease cycle culture of microorganisms pure and batch culture. Morphological features and modifications of Leaves, Flower and Inflorescence, fruits, stem and root. Botanical nomenclature – rules and typification. ICNAFP. APG system of classification. Influence of biotic and abiotic factors on vegetation. Eco system and its components. Pollution types and its control measures. Natural Disaster Management. Biodiversity and its conservation.

#### **Unit VIII: Developmental Botany (20 Questions)**

Meristems and Tissues (Simple and Complex). Structure and development of Anther and Ovule. Double fertilization and Triple fusion seed – Structure, germination, viability and dormancy. Ultrastructure of prokaryotic and Eukaryotic cell. Morphology, types and functions of chromosomes. Mendelian genetics. Sex determination in plants. Absorption of water and minerals mineral nutrition in plants. Physiological role of growth regulators photosynthesis – Light and Dark reaction. Respiration – types, Kerb's and glycolysis, CAM pathway.

#### **Unit IX: Non-Chordata and Chordata: (15 Questions)**

Non-Chordata: General organization - Classification upto classes. Prochordata - Amphioxus. Chordata - General organization- outline classification upto class level. Symmetry and Coelom. Outline classification of insects - Morphology, mouthparts, and life cycle - Hormonal development - Social life in insects - Beneficial and harmful insects – Traps and their types in godown - Physical, chemical, biological and pheromone traps.

#### **Unit X: Physiology and Biochemistry (20 Questions)**

Biochemistry: Biomolecules - Structure and functions of carbohydrates, Proteins and lipids. Physiology: Digestion, Nutrition, balanced diet and assimilation. Composition of blood. Nerve impulses and conduction. Cell Biology: Cellular organelles - Structure and functions - DNA structure and function and replication. Immunology: Types of immunity, antigen and antibody- Vaccination. Genetics: Sex chromosomes - Genetic disorders. Developmental Biology: Gametogenesis - Fertilization. Environmental Biology: Ecosystem, structure and functions - Intra and inter specific association. Evolution: Theories of evolution - Mimicry in Evolution - Fossils and Human evolution.

### **4. Archaeology (PG Degree Standard)**

**Code: 420**

#### **Unit I: Cultural History of Tamil Nadu (14 Questions)**

Primary Sources - Cultural History: Sangam Age, Post - Sangam Age, The Pallava, Pandya, Chola, Chera, Vijayanagara and Nayaka periods – Socio-Economic and Religious Life – Trade and Commerce – Science and Technology.

#### **Unit II: History of Archaeology (16 Questions)**

Development of Archaeology in the World: Archaeological Theories – Development of Archaeology in India: Indological Studies, William Jones, James Prinsep, Alexander Cunningham, John Marshall and

Mortimer Wheeler - Development in the Post-Independence Period: Archaeological Survey of India, Tamil Nadu State Department of Archaeology and University Departments - National Mission on Monuments and Antiquities (NMMA) – National Monument Authority (NMA)

### **Unit III: Field Archaeology (24 Questions)**

Exploration Methods and Techniques - Excavation Methods and Techniques – Archaeological Stratigraphy – Marine Archaeology- Geoarchaeological Applications -Dating Methods: Absolute and Relative –Analysis of excavated materials– Scientific analysis – Documentation – Interpretation and Excavation Report Writing

### **Unit IV: Pre and Proto History of India (24 Questions)**

Indian Prehistory - Geoarchaeology - Lower Palaeolithic, Middle Palaeolithic and Upper Palaeolithic Cultures - Mesolithic Culture – Neolithic Culture – Rock Art in India - Chalcolithic Cultures – Harappan Culture – Iron Age / Megalithic Culture - NBPW Culture. Archaeological Sites: Teri Sites, Adichanallur, Sivakalai, Mayiladumparai, Paiyampalli, Pattaraiperumpudur and Attirampakkam

### **Unit V: Epigraphy and Palaeography (30 Questions)**

Epigraphy as a Source- History of Indian Epigraphy – Harappan Signs and Graffiti - Palaeography: Brahmi and Kharoshti Scripts – Asokan Inscriptions – History of Epigraphy in Tamil Nadu -Origin and Development of Tamizhi (Tamil - Brahmi), Vattezhuttu, Tamil and Grantha. Structure of stone and copper plate Inscriptions – Prasasti/Meikirti - Select Inscriptions: Pulimankombai, Mangulam, Jambai, Pugalur, Arachalur, Pulankurichi, Porpanaikkottai, Manur, and Tirumukkudal – Select Copper Plates: Pallankoil, Kuram, Chinnamanur, Dalavaipuram, Esalam and Thiruvalangadu

### **Unit VI: Numismatics (10 Questions)**

Numismatics as a source – Introduction to Currency System - Punch Marked Coins – Coins: Sangam Age, Roman, Satavahana, Gupta, Pallava, Pandya, Chola, Vijayanagara and Nayaka – Mint and Techniques

### **Unit VII: Art and Architecture (12 Questions)**

Art and Architecture: Harappan, Buddhist, Mauryan, Satavahana, Gupta, Chalukya, Rashtrakuta, Hoysala, Vijayanagara and Nayaka- Art and Architecture: Chandelas and Odisha Architecture - Art and Architecture of Tamil Nadu: Pallava, Pandya, Chola, Vijayanagar, Nayaka and Secular Architecture.

### **Unit VIII: Iconography and Paintings (10 Questions)**

Introduction to Iconography – Ancient Texts of Iconography – Mudras and Asanas- Buddhist and Jain Iconography, Saiva and Vaishnava Iconography - Chola Bronzes, Mural Painting: Pallava, Pandya, Chola, Vijayanagara and Nayaka.

### **Unit IX: Conservation and Heritage Management (20 Questions)**

Classification of Cultural Properties: Tangible and Intangible – Concept and Methods of Conservation - Conservation: Prehistoric and Excavated Remains, Rock Cut Caves and Built Heritage – Preservation of Mural Paintings –Marshall's *Conservation Manual* (1923) - Introduction to Heritage Management - Indian Antiquarian Laws: Indian Treasure Trove Act 1878, Ancient Monuments Preservation Act 1904, The Ancient Monuments and Archaeological Sites and Remains Act 1958 - Heritage Education – World Heritage Monuments.

### **Unit X: Historical Archaeology (40 Questions)**

Historical Archaeology – Ancient Ceramics of India - Excavated Sites in India: Sisupalgarh, Kausambi, Hastinapur, Ahichchitra, Nalanda, Taxila, Pataliputra, Vikramsila, Adam, Nagarjunakonda, Amaravati, Hampi, Pattanam(Musiri) - Sites of Tamil Nadu: Korkai, Mangudi, Alagankulam, Keeladi, Porunthal, Kaveripoompattinam, Vallam, Uraiyur, Karur, Kodumanal, Tirukkivilur, Kanchipuram, Vasavasamudram, Arikamedu and Gangaikondacholapuram

**5. Archaeology / Epigraphy / Heritage Management and Museology  
(PG Diploma Standard)**

**Code: 421**

**Unit I: Cultural History of Tamil Nadu (20 Questions)**

Primary Sources - Cultural History: Sangam Age, Post-Sangam Age, Pallava, Pandya, Chola, Chera, Vijayanagara and Nayaka periods – Socio-Economic and Religious Life.

**Unit II: History of Archaeology (20 Questions)**

Development of Archaeology in India: Indological Studies, William Jones, James Prinsep, Alexander Cunningham, John Marshall and Mortimer Wheeler - Developments in the Post-Independence Period; Archaeological Survey of India, Tamil Nadu State Department of Archaeology and University Departments.

**Unit III: Field Archaeology (20 Questions)**

Exploration Methods and Techniques - Excavation Methods and Techniques – Archaeological Stratigraphy – Dating Methods: Absolute and Relative – Analysis of excavated materials – Documentation - Excavation Report Writing.

**Unit IV: Pre and Proto History of India (20 Questions)**

Indian Prehistory - Lower Palaeolithic, Middle Palaeolithic and Upper Palaeolithic Cultures - Mesolithic Culture – Neolithic Culture – Rock Art in Tamil Nadu - Chalcolithic Cultures – Harappan Culture – Iron Age / Megalithic Culture.

**Unit V: Epigraphy and Palaeography (30 Questions)**

Epigraphy as a Source- History of Indian Epigraphy – Harappan Signs and Graffiti - Palaeography: Brahmi and Kharoshti Scripts – Asokan Inscriptions – History of Epigraphy in Tamil Nadu -Origin and Development of Tamizhi (Tamil -Brahmi) – Vattezhuttu, Tamil and Grantha - Structure of stone and copper plate Inscriptions – Prasasti/Meikirti - Select Inscriptions: Pulimankombai, Mangulam, Pulankurichi, Tirumukkudal – Select Copper Plates: Pallankoil, Esalam and Thiruvallangadu.

**Unit VI: Numismatics (10 Questions)**

Numismatics as a source – Introduction to Currency System - Punch Marked Coins – Coins: Sangam Age, Roman, Pallava, Pandya, Chola, Vijayanagara and Nayaka – Mint and Techniques.

**Unit VII: Art and Architecture (20 Questions)**

Art and Architecture: Harappan, Buddhist, Mauryan, Satavahana, Gupta, Chalukya, Rashtrakuta, Hoysala, Vijayanagara and Nayaka - Art and Architecture of Tamil Nadu: Pallava, Pandya, Chola, Vijayanagara, Nayaka and Secular Architecture.

**Unit VIII: Iconography and Paintings (16 Questions)**

Introduction to Iconography – Mudras and Asanas- Buddhist and Jain Iconography, Saiva and Vaishnava Iconography - Mural Paintings: Pallava, Pandya, Chola, Vijayanagara and Nayaka.

**Unit IX: Conservation and Heritage Management (14 Questions)**

Classification of Cultural Properties: Tangible and Intangible – Concept and Methods of Conservation – Conservation of Cultural Heritage - Marshall's *Conservation Manual* (1923) - Introduction to Heritage Management - The Ancient Monuments and Archaeological Sites and Remains Act 1958 - Heritage Education – World Heritage Monuments.

**Unit X: Historical Archaeology (30 Questions)**

Historical Archaeology – Ancient Ceramics of Tamil Nadu – Excavated Sites of Tamil Nadu: Korkai, Mangudi, Alagankulam, Keeladi, Porunthal, Kaveripoompattinam, Vallam, Uraiyur, Karur, Kodumanal, Arikamedu and Gangaikondacholapuram.

## **6. Architecture (Degree Standard)**

**Code: 401**

### **Unit I: Introduction to Architecture (25 Questions)**

Definition of Architecture - Integration of aesthetics and function. Elements of Architecture – Form, Space, light, colour, etc. Principles of Architecture – Proportion, Scale, balance, rhythm, symmetry, hierarchy, pattern and axis. Understanding of organization of form and space, volumetric study, architectural characteristics & style of buildings with examples. Understanding user circulation and spatial requirement for all types of buildings. Universal design principles and Barrier free environment. Functional aspects of architecture – site, structure, skin, circulation etc. Principles of composition and relationship between human activities and anthropometrics. Computer application in Architecture- Architectural graphics - Drawing & visualization tools – image editing, 2D & 3D modelling, 3D visualization.

### **Unit II: History of Architecture & Culture (20 Questions)**

Historical development of Egyptian, West Asian, Greek & Roman Architecture with examples. Historical development of Buddhist Architecture with examples. Evolution of Hindu Temple Architecture – Dravidian and Indo-Aryan Periods- Outstanding examples of these periods. Historical development of Indo- Islamic Architecture – Delhi Sultanate, Provincial & Mughal styles with examples. Modern Architecture - development of theories, various philosophies & schools of thoughts, works of modern architects. Post Modern Architecture - various philosophies, works of postmodern architects. Architecture of India under Colonial rule. Post-independence architecture in India - works of Indian Architects. Contemporary World Architecture & recent trends

### **Unit III: Materials and Construction Techniques (25 Questions)**

Properties, characteristics, strengths, manufacturing, components & applications of materials, construction methods and techniques, detailing for the following : Stone – Brick & Clay Products – Lime – Cement – Mortar – Timber – Concrete – Ferrous and Non-Ferrous Metals – Glass – Plastics – Asphalt, Sealants & Adhesives – Protective and Decorative Coatings – Surface finishing & flooring materials - Water Proofing and Damps Proofing Materials – Rural Building Materials(Bamboo, Soil, etc.). Building structural systems, prefabrication of building elements; principles of modular coordination-construction planning and equipment. Principles and design of disaster resistant structures. Temporary structures for rehabilitation. Specification – necessity, importance, types & classification – Specification writing - Estimation (Approximate & detailed) – Current trends. Advanced construction technologies - Construction systems & Practice

– Construction methods & equipments, Construction Technology for High-rise buildings, Construction management.

### **Unit IV: Building and Services – Current Development & New Trends (20 Questions)**

Water Supply and sanitation systems: Sources, Quality, treatment methods and distribution systems of water - water requirements for firefighting systems and different building typologies – Primary and Secondary waste water treatments, Modern types of sewage treatment plants. Choice of pipe materials, fittings & fixtures - Systems of water supply and sewage disposal in all types of buildings. Water harvesting systems – Principles, planning and design of storm water drainage systems. Solid Waste – Methods of solid waste management - collection, transportation and disposal – Recycling and Reuse of Solid waste – MSW rules. Electrical installations in buildings- Single/three phase supply - Planning electrical wiring for building - Building safety and security systems- Building Management systems, Building automation. Lighting – Design, Installation & Application in buildings. Mechanical ventilation techniques: Air conditioning – Systems & Applications configuration, sizing & space requirements. Vertical transportation systems – Design criteria & installation of Elevators, Escalators & moving walkways. Fire safety and firefighting systems – requirements and norms, NBC guidelines. Architectural Acoustics – Fundamentals, Importance of shape volume, treatment of interior surfaces. Relevant National and state level legislations and guidelines.

### **Unit V: Human Settlements Planning (20 Questions)**

Origin of Human settlements In India & the rest of the world – River valley civilizations (Indus Valley, Mesopotamia, Egyptian & Chinese) – Traditional planning principles in India – approaches & concepts – Classical & Medieval planning in Europe and India - Evolution of modern planning theory, concepts and

works of town planners - Planning models. Elements of Human settlements – functions & linkages, Structure & form. Types of plan like Regional plan, Perspective plan, Master plan, Zonal plan etc. URDPFI and RADPFI Guidelines, DCR,CRZ for coastal areas; JNNURM, AMRUT, Zoning regulations, SEZ, PUD,TOD; Contemporary Urban planning – Issues and Trends. National and state level government organizations -initiatives, schemes and projects.

#### **Unit VI: Urban Studies – Urban Design, Urban Housing & Conservation (25 Questions)**

Urban Design – need, aspects, scope & components of urban space – Indian Urbanism - Theorising & Reading urban space – Imageability & townscape elements, social aspects of urban space, gender & class – URDPFI guidelines. Urban Renewal, Redevelopment, Rehabilitation & Conservation, TDR. Urban Public spaces – Universal design, pedestrian friendly environment, streetscapes. Housing in the Indian Context, Socio-Economic aspects, Housing standards, Site Planning & Housing Design. Vernacular architecture of India and Heritage tourism; Smart city and Sustainable urban development. Conservation in India – Understanding the need & purpose, definition, Adaptive re- use, International agencies & their role – Policies & legislations, case studies – Conservation practice and Planning; National and state level government organizations – Initiatives, schemes and projects; Relevant National and state level legislations and guidelines

#### **Unit VII: Environmental Studies, Site Planning & Landscape Ecology (25 Questions)**

Environment, Ecosystems & Bio-diversity – Environmental Pollution, Human population & social issues with relation to the environment – Environmental laws in India. Site Planning – Introduction to basic terminologies, Methods of surveying, Instruments & Application, Levelling, Site Drawings, Importance of Site Analysis – On-site & off-site factors, Study of micro climate, Site Diagramming, Site Context, Site planning & Site layout principles. Topographical study and Contour Analysis. Introduction to Landscape Architecture – Elements of Landscape Design – plant material, water & landforms, Garden Design – Japanese, Italian Renaissance & Mughal, Site Planning – Organization of spaces – circulation, built form and open spaces, site planning and micro climate, site planning for neighborhood parks, children's play area and campus development – Landscaping of Functional areas – Urban open spaces and principle of urban landscape – Street landscaping, landscape design for waterfront areas and functional areas in urban centers – green roofs and walls.

#### **Unit VIII: Climatic Design & Energy Efficient Architecture (20 Questions)**

Climate & Human comfort, Visual and Acoustical comfort in built environment. Solar Control, Heat flow through materials & building envelope design, Air movement patterns through natural & built forms, Design strategies for different climate types. Energy Efficiency – Importance & Significance, Passive Heating & Cooling techniques, case studies, day Lighting & Natural ventilation, Use of Renewable energy systems – Current & future trends. National and state level government organizations -initiatives, schemes and projects. Relevant National and state level legislations and guidelines.

#### **Unit IX: Project Management and Current Trends (10 Questions)**

Project Management – Introduction, Project programming & Critical path method, Cost model analysis, Programming evaluation review technique – PERT network - Project feasibility study - Facility Programming and Planning. Computerized Project Management, Current trends - various international and national agencies - Funding and implementation procedure.

#### **Unit X: Professional Practice and Ethics (10 Questions)**

Understanding the basic concepts and terminology in architectural practice -Architectural profession – Code of conduct & ethics and profession. Role of Architects in conceptualizing, design proposal until the execution procedure. Role of COA & IIA – Architect's Services, Scale of fees, Architectural Competitions - Tender & Contracts – Legal aspects – Important Legislations & current trends.

## 7. Basics of Engineering (Degree Standard)

Code: 422

### UNIT I: Mathematics (20 Questions)

Matrices: Eigen values – Eigen vectors of a real matrix - Cayley - Hamilton theorem - Similar and Orthogonal transformations - Reduction of a quadratic form to Canonical form by orthogonal transformation. Ordinary differential equations: Order and degree - Higher order linear ODE with constant coefficients - Method of undetermined coefficients - Method of variation of parameters - Cauchy's and Legendre's linear equations. Functions of several variables: Partial derivatives - Total derivatives - Euler's theorem - Implicit functions - Jacobians - Taylor's theorem - Maxima and Minima. Integration: Definite and indefinite Integrals - Techniques of integration using integration by parts and Trigonometric Integrals - Double Integrals - Change of order of integration - Volume Integrals. Vector Calculus: Vectors and scalars - Gradient and Directional derivatives - Divergence and Curl - Applications of Green's theorem, Gauss divergence theorem and Stoke's theorem. Complex variables: Analytic functions - Verification of Analyticity - Construction of Analytic functions - Conformal Mappings - Bilinear transformations. Complex Integration: Cauchy's integral theorem - Cauchy's fundamental theorem - Cauchy's residue theorem - Taylor's and Laurent's series - Contour integration (excluding poles on the real axis). Laplace transform: Existence of Laplace transform - Laplace transform of elementary functions- Properties - Laplace transform of Periodic functions - Inverse Laplace transform - Convolution theorem - Solution of linear second order ODE by Laplace transform technique.

### UNIT II: Engineering Physics (25 Questions)

Mechanics: Newton's laws of motion – gravitation – work, energy and power - Properties of matter : Elasticity – moduli of elasticity - Sound : intensity level – reverberation – Ultrasonics : production, detection and applications - Thermal Physics : Thermal expansion - thermal stress - expansion joints - bimetallic strips - thermal conductivity- heat conductions in solids – flow of heat through compound media – Thermodynamics – Laws of thermodynamics – Carnot engine - Applied Optics : Interference – Young's double slit experiment - anti-reflection coatings - Diffraction - Lasers – principle and applications – CO<sub>2</sub> and Nd:YAG laser - semiconductor lasers – applications of Lasers – Optical fibres: classification (index & mode based) - principle and propagation of light in optical fibres - acceptance angle and numerical aperture - fibre optic communication system - Quantum Physics : Photoelectric effect– dual nature of matter and radiation – Heisenberg's uncertainty principle - Schrödinger's wave equation - Physics of Materials : Crystal structures – unit cell – packing factor – Superconductivity : Properties and applications - Magnetisation of matter: Magnetic dipole moment – atomic magnetic moments- magnetic permeability and susceptibility - Magnetic material classification : diamagnetism – paramagnetism – ferromagnetism – Semiconductors : Intrinsic Semiconductors – Energy band diagram – direct and indirect band gap - extrinsic semiconductors – Dielectric materials: Matter polarization and relative permittivity - dipole moment and polarization vector -polarization mechanisms: electronic, ionic, orientational, interfacial and total polarization- frequency dependence - dielectric strength and break-down in gases, liquids and solids.

### UNIT III: Engineering Chemistry (25 Questions)

Fuel -Classification of fuels - Calorific value - Solid fuel - Liquid fuel - Gaseous fuel - Octane number - Cetane Number -Lubricants - Classification - Greases - Solid Lubricants. Water - Sources - Classifications - Softening process - Desalination - RO Method - Internal treatment - Treatment of Water for Municipal purposes. Plastics - High polymer - classification - Polymerization techniques - Thermoplastics - Thermosetting resins - examples. Rubber -Types of Rubber - Vulcanisation - Properties- Unvulcanised and Vulcanised. Natural Rubber - Synthetic Rubber - examples. Refractories - Classification - Manufacture of Refractories - Magnesite - Silica - Zirconia -Chromite. Abrasives - Natural - Artificial-Abrasive paper & cloth. Corrosion: Dry and Wet corrosion - Factors affecting corrosion- Different types of corrosion. Productive coating - Hot dipping- metal cladding, electro deposition - Organic Coatings - Paints - Varnishes. Cement and lime- setting and hardening. Explosives- classifications - characteristics-requirements for good explosives- nitrocellulose- TNT- TNB-DNB-PETN-RDX. Alloys- purpose of making alloy- types of alloys- Ferrous alloys. Electrochemistry - conductors and non-conductors - Kohlrausch law - Electrochemical cell- reversible and irreversible cells - EMF - Concentration cell- polarization - over voltage, decomposition potential. Fuel Cells. Nano Chemistry-Basics- distinction between molecules, Nano materials and bulk materials. Size dependent properties and applications of Nano Materials.

#### **UNIT IV: Basics of Computer Engineering (25 Questions)**

Computer Organisation - CPU and Microprocessor [ALU, Control Unit and Bus Structure] - Data Storage [Primary, Secondary and Virtual] - Input and Output Devices.

System Software - Assembler - Compiler - Loader - Linker - Operating Systems.

Programming Languages - Classification of Programming Language, Algorithm, Flow chart, Pseudo code, High-Level Languages – Fundamental concepts of C Programming.

Basic Computer Networking - Network Components [Routers, Bridges, Gateways] - ISO-OSI Reference Model - LAN - WAN - Client-Server Architecture - Internet - World Wide Web.

Applications - Office Tools - Word processor - Spreadsheet - Power point - Introduction to Database concepts - E-mail - Browser.

IT Enabled Services - E-Governance - E-Commerce - Multimedia.

#### **UNIT V: Basics of Civil and Mechanical Engineering (30 Questions)**

Introduction to Engineering mechanics - Units and Dimensions - Laws of Mechanics - Coplanar Forces - Static Equilibrium of Rigid body - Moment of force - free body diagram - friction - laws of friction - sliding friction - wedge friction - Rolling resistance - Lader friction - Friction in screws - Screw jack -Belt friction - Properties of surfaces and solids - Centroids and centre of mass - line and areas - Rectangular, circular, triangular areas by integration - T-section, I- Section, Angle section, Hollow section - Area moment of inertia of plane areas - Parallel axis theorem – Perpendicular axis theorem, Polar moment of Inertia, Principle moment of Inertia Mass moment of inertia- Centroid of the simple solids - Dynamics of particle - Displacement, velocity and acceleration - Different types of motion - Rectilinear , Curvilinear and Projectile motions - Newton's II-law of motion - Work Energy equation - Impulse and momentum principles.

#### **UNIT VI: Basics of Electrical and Electronics Engineering (30 Questions)**

Ohm's law – Kirchoff's laws – Introduction to DC and AC circuits - single phase and three phase circuits – Power and Power factor, Unbalanced and Balanced loads, Operating principles of moving coil and moving iron instruments (voltmeters and ammeters) – wattmeters, multimeter, energy meters and megger, Construction and principle of operation: DC motors- DC generators-Transformers- Induction motors, Characteristics of PN junction diode - zener diode- half wave and full wave rectifiers - Bipolar junction transistor (CC,CE,CB configurations), SCR, Amplifiers- Operational amplifiers – Inverting and Non-inverting amplifiers, Binary number system- logic gates- Boolean algebra - Half and full adders- Flip-flops - registers and counters- A/D and D/A conversion, Types of analog and digital signals- Modulation and Demodulation(amplitude and frequency) Communication systems: Radio- TV- Fax- Microwave-Satellite and optical fibre.

#### **UNIT VII: Principles of Management (15 Questions)**

Management - Definition, Evolution of Management Philosophies, Types of Business, Environment Analysis - Planning- Types, Steps, Forecasting, MBO, MBE. Organizing – Departmentation, Line and Staff Authority, Delegation and Decentralization. Staffing - Manpower Planning, Recruitment and Selection, Training, Performance Appraisal. Directing – Theories of Motivation, Leadership Styles, Power and Politics, Change Management, Conflict Management, Communication in Business- Controlling Types, Control Techniques, Budgetary and Non-Budgetary Control.

#### **UNIT VIII: Total Quality Management (15 Questions)**

Quality – Definitions, Vision, Mission and Policy statements-Dimensions of Product and Service Quality- Contributions of Quality Gurus-Deming, Juran, Crosby, Masaaki Imai, Feigenbaum, Ishikawa. Costs of Quality- Continuous Process Improvement- PDCA, Quality Circle, 5S, Kaizen-Statistical Process Control (SPC), 7QC Tools, New Management Tools of Quality, Bench Marking, 6 sigma, Quality Function Deployment (QFD), POKAYOKE, Total Productive Maintenance (TPM), Business Process Reengineering (BPR), Quality Certifications.

#### **UNIT IX: Environmental Science and Engineering (15 Questions)**

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ. Environmental pollution: Causes, Effects and Preventive measures of

Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Energy management and conservation, New Energy Sources - Need of new sources. Different types of new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy. Sustainability and management - Development , GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols-Sustainable Development Goals-targets, indicators and intervention areas. Climate change- Global, Regional and local environmental issues and possible solutions. Concept of Carbon Credit - Carbon Footprint. Environmental management in industry- Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

## **8. Business Administration PG Degree Standard**

**Code: 385**

### **Unit I: Management Concepts (15 Questions)**

The development of Management thought-Pre scientific management era – Human relation era – Social sciences era – Management sciences era. Definitions of Administration and Management – Basic Principles and Process of Management. Functions of Management: Planning, Organising, Staffing, Directing, Coordination and Controlling. Management by objectives – Process of MBO – Management by Exception.

### **Unit II: Managerial Economics (10 Questions)**

Introduction to Economics; Nature and Scope of Managerial Economics – Significance in Decision - Making and Fundamental Concepts - Objectives of a Firm - Role of Economic Analysis in managerial decisions. The Concept of Profit. Nature and Measurement of Profits - Profit Maximization - Profit Planning and control – Profit Policies – Cost Volume Profit Analysis. National Income – Definition, Concepts and Various Methods of its Measurement– Inflation, Types and Causes - National Income and Economic Welfare-Business Cycles and Business Forecasting – Measuring Business Cycles Using Trend Analysis

### **Unit III: Organisational Behaviour (20 Questions)**

Organisational Behaviour :Importance – Historical Development of Organisation Behaviour- Understanding Individual :Personality- Perception-Learning-Values-Attitude- Job Involvement – Organisational Commitment – Job Satisfaction – Emotions – Emotional Intelligence – Spiritual Quotient. Understanding groups: Meaning of group and group dynamics – Theories of Group Dynamics – Group Cohesiveness – Team Building- Management of change-Organisational Culture-Management of Conflict- Organizational Citizenship Behaviour.

### **Unit IV: Human Resource Management (20 Questions)**

Functions of HRM – Managerial Functions and Operative functions – Organisation of HRM Department – Qualities and Qualification of HR Managers – HR Policies - Environmental influences of HRM – HRM Challenges – HRM Strategies. Recruitment and Selection- Job Analysis- Job Evaluation-Performance Appraisal-Training and Development-Quality of Working Life-e HRM

### **Unit V: Research Methodology and Statistics (10 Questions)**

Research – Meaning – Types – Nature and scope of research – Review of Literature - Problem formulation – Statement of research Objective – Value and cost of information – Research Questions – Research Gap - Decision theory – Research process – Research designs – Experimental Research. Methods of data collection – Sampling – Measure of Central Tendency -Measure of Dispersion - Testing of Hypothesis – Correlations - Regression- Multivariate Analysis - Research Report

### **Unit VI: Operations Management (20 Questions)**

Operations Management concept, objectives and types – Characteristics of Modern Operation Management – Differences between Services and Goods – Operation Strategy – Supply Chain Management – Warehousing and Supply Chain Strategies – Supply Chain Dynamics. Operations

Planning- Work study: Objectives, Procedures – Method Study and Motion Study - Work Measurement and Productivity. Total Productive Maintenance- Materials management and Purchase Management - Project management - Quality Control – Quality Movement – Continuous Improvement – Tools – Total Quality Management (TQM) concepts – ISO Quality Certification – Quality Assurance.

#### **Unit VII: Marketing Management (50 Questions)**

Marketing – Definition – Importance – Concepts in Marketing, Marketing Concepts – Traditional and Modern Concepts – Marketing Environment, Marketing Strategies – Kinds of Marketing Strategies – Marketing Mix Concept – Marketing Research and Information – Objectives and Process. Consumerism – Problems of consumer protection – Developments in Consumer Protection in India - Government and Marketing – Neo Marketing Trends – e-Marketing – Tele-marketing – Green Marketing – Event Marketing – Viral Marketing – Direct Marketing- Ethics in Marketing & Advertisement.

#### **Unit VIII: Management Information System & E-Commerce (20 Questions)**

Data, Information, Intelligence, Information Technology, Information System, Functional Information Systems, DSS, EIS, KMS, GIS, International Information System-Data Base Management System- Role of information management in ERP, e-governance, Data Mining, Business Intelligence, Pervasive Computing, Cloud computing, CMM. Electronic Commerce: Technical Components of E-Commerce Functions of E-Commerce - Advantages and disadvantages of E- Commerce -Electronic Commerce and Electronic Business - Electronic Commerce Technology - Building the E-Business application - Avoiding legal issues- Web strategy: Attracting and retaining visitors - Search Engines and Portals- Cyber service - Online Banking.

#### **Unit IX: Accounts and Auditing (10 Questions)**

Basic Accounting concepts - Kinds of Accounts. Double Entry Book Keeping - Journal and Ledger Accounts- Subsidiary books- Trial balance - Errors – Types of errors - Rectification of errors – Bank reconciliation statement – Manufacturing - Trading - Profit & Loss Account - Balance sheet. – Accounting for non-trading Institutions-Income & Expenditure Account-Receipts and Payment Accounts and Balance sheet – Accounting for depreciation – methods of depreciation –Preparation of accounts from incomplete records. Auditing – Origin – Objectives – Types - qualities of an Auditor - Audit programmes - verification and valuation of Assets and Liabilities. Investigation-objectives of investigation - Audit of computerized-Accounts - electronic auditing

#### **Unit X: Financial Management (25 Questions)**

Finance Functions – Nature And Scope – Evolution Of Finance Function – Its New Role in The Contemporary Scenario – Goals Of Finance Function – Maximising Profit Vs Wealth – Cost – Risk – Return- Trade Off – Concept Of Time Value Of Money – Future Value and Present Value and The Basic Valuation Model - Sources Of Short Term Financing – The Management Of Working Capital -Cash Management Strategies - Receivables Management- Sources of Long Term Finance - Cost Of Capital and Capital Structure - Economic Value Added (EVA)-Risk and Uncertainty - Risk Management- Return on Investment.

### **9. Chemistry (Degree Standard)**

**Code:430**

#### **UNIT I: Physical Chemistry (35 Questions)**

**(a) Chemical Thermodynamics: (25 Questions)** Terminology – Systems and surroundings - First Law of thermodynamics -  $C_p$  and  $C_v$  relation - Hess's law of constant heat summation - Kirchoff's equation - extensive and intensive properties- second law of thermodynamics - entropy and entropy as a measure of probability - Free energy and Chemical equilibria - variation of free energy with temperature and pressure - Gibb's and Helmholtz equation – Heterogeneous equilibria and Le Chatlier principle.

**(b) Solid State Chemistry: (10 Questions)** Crystalline and amorphous solids - unit Cell - Miller Indices – symmetry elements in crystals (cubic system only)- Bragg's equation - radius ratio's and packing in crystals- determination of crystal structures by Bragg's method – structure of NaCl, Wurzite ,  $TiO_2$  and spinels.

## UNIT II: (30 Questions)

**(c) Chemical Kinetics: (15 Questions)** Rate laws - rate constant - order and molecularity of reactions - I, II, III, and zero order reactions – concept of Arrhenius theory - Collision theory and Transition state theory -catalysis.

**(d) Electrochemistry: (15 Questions)** **Conductance in electrolytic solution, specific and molar conductance** - Ostwald's dilution law - Kohlraush's law - Debye Huckel theory- Types of reversible electrodes - Nernst equation - reference electrode and standard hydrogen electrode - computation of cell e.m.f. -calculations of thermodynamic quantities of cell reactions ( $\Delta G$ ,  $\Delta H$ ,  $\Delta S$  and  $K$ ) Determination of pH and pKa of acids by potentiometric methods.

## UNIT III: (12 Questions)

**(e) Analytical chemistry and Instrumental methods:**

Principle, instrumentation and applications of UV- Visible, IR, Raman, NMR, Mass, GCMS and Atomic Absorption spectroscopy.

## UNIT IV: (20 Questions)

### Inorganic Chemistry

**(f) Periodic classification: (14 Questions)** Classification based on electronic configuration – periodic properties - atomic and ionic radii, ionisation potential, electron affinity and electronegativity - various scales - Trends along periods and groups.

**(g) Chemical bond: (3 Questions)** Lattice energy - VSEPR Theory and its applications - partial ionic character from electronegativity - Fajan's Rule.

**(h) Compounds of Boron: (3 Questions)** Electron deficient nature of boron compounds - preparation and properties of halides and nitrides of boron - diborane - Borazine, silicones and structures of silicates

## UNIT V: (20 Questions)

**(i) Lanthanides and Actinides: (7 Questions)** Position in the periodic table, occurrence, electronic configuration, oxidation state - lanthanide contraction - magnetic properties and complexation behaviour - comparison of lanthanides and actinides.

**(j) Nuclear Chemistry: (13 Questions)** Radio activity - detection and measurement – Half-life period - nuclear stability, - n/p ratio - isotopes, isobars and isotones -nuclear reactions - spallation - nuclear fission and fusion - stellar energy Uses of nuclear energy - nuclear power projects in India - Applications of radioactive isotopes in industries, medicine and agriculture.

## UNIT VI: (20 Questions)

**(k) Co-ordination Chemistry: (10 Questions)** Nomenclature – theories of co-ordination compounds- Werner, valence bond, crystal field theories - Effective atomic number – isomerism.

**(l) Analytical Chemistry: (10 Questions)** Principles of volumetric analysis - different types of titrations- Gravimetric analysis – Basic principles - Separation and purification techniques

## UNIT VII: (25 Questions)

### Organic Chemistry:

**(m) Nature of Bonding: (18 Questions)** Hybridisation ( $sp$ ,  $sp^2$  and  $sp^3$ ) and Geometry of molecules - cleavage of bonds - homolytic and heterolytic fission of carbon – carbon bonds - Reaction intermediates - free radicals, carbocations and carbanions - their stability.

**(n) Types of reactions: (7 Questions)** Nucleophilic, electrophilic, free radicals, addition, elimination, substitution, oxidation and reduction reactions.

## UNIT VIII : (18 Questions)

**(o) Electron displacement effects: (8 Questions)** Inductive, inductometric, electromeric, mesomeric, resonance, hyperconjugation and steric effects.

**(p) Stereochemistry: (10 Questions)**

Optical isomerism and Geometrical isomerism - chirality - optical isomerism of lactic and tartaric acid - Racemisation – Resolution-asymmetric synthesis - Walden inversion - cis and trans isomerism of maleic and fumaric acids-R-S-Notations - conformational analysis of cyclohexane

**UNIT IX : (5 Questions)**

(q) Carbohydrates: Classification, sources, preparation and reactions - Glucose, Fructose, Sucrose and lactose- structure of glucose and fructose.

(r) Amino acids – Classification - Zwitter ion - peptide linkage - structure of proteins - structure and functions of DNA and RNA

(s) Hormones and vitamins - Classifications, sources and functions

**UNIT X : (15 Questions)**

**(t) Pharmaceutical Chemistry: (10 Questions)** Terminology-pharmacology, pharmacotherapies, toxicology, chemotherapy, classification and nomenclature of drugs, sources of drugs, Assay of drugs by biological, chemical and immunological methods, physiological effects of functional groups of drugs - Different types of drugs like analgesics, antibiotics, antiseptics, disinfectants, anaesthetics, antacids, antimalarial antidepressants, antipsychotic and sedatives.

**(u) Nano Chemistry: (5 Questions)**

Definition – types of nano materials – Nano drugs and their delivery- Applications of nano materials in medicine

**10. Civil Engineering  
(Degree Standard)****Code: 398****Unit I: Building Materials and Construction Practices (20 Questions)**

Properties and testing of engineering materials-brick, stones, M-sand, aggregates, cement, timber, recycled and modern materials-glass, plastic FRP, ceramic- concrete – properties and testing - mix design-admixtures, Self-compacting concrete steel construction practice-stone masonry, brick masonry ,R.C.C. and block masonry – construction equipment - building bye-laws and development regulations practiced in Tamil Nadu - Provisions for fire safety, lighting and ventilation- Acoustics.

**Unit II: Engineering Survey (15 Questions)**

Survey - Chain- Compass - Plane table - levelling - Theodolite- computation of area and volume-L.S. and C.S. – Contour - Traversing – traverse adjustment- -Heights and Distances - Tacheometry and Triangulation - total station and GPS and Remote sensing techniques for surveying.

**Unit III: Engineering Mechanics and Strength of Materials (20 Questions)**

Forces- types-laws - centre of gravity-moment of inertia-friction-Stresses and strains -Thermal stress - elastic constants - Beams - Bending moment and shear force in beams - Theory of simple bending - deflection of beams - torsion - Combined stresses – stresses on inclined planes - Principal stresses and principal planes - Theories of Failure – Analysis of plane trusses.

**Unit IV: Structural Analysis (20 Questions)**

Indeterminate beams - Stiffness and flexibility methods of structural analysis - Slope deflection - Moment Distribution method – Arches and suspension cables - Theory of columns - moving loads and influence lines – Matrix method- Stability of retaining walls – plastic theory- Seismic analysis of high rise building

**Unit V: Geotechnical Engineering (25 Questions)**

Formation of soils - types of soils - classification of soils for engineering practice - Field identification of soils - Physical properties and testing of soils - Three phase diagram - permeability characteristics of soils - stress distribution in soils - Theory of consolidation, shear strength parameters of soils –

stabilization of soil -Compaction of soils- Stability analysis of slope - Soil exploration - Soil sampling techniques – SPT -Borelog profile - shallow foundations - Terzhagi's bearing capacity theory - Pile foundation –pile load test- Group action of piles - settlement of foundations- Ground Improvement techniques.

#### **Unit VI: Environmental Engineering and Pollution Control (15 Questions)**

Sources of water - Water Demand -- Characteristics and analysis of water – hydraulics for conveyance and transmission - water borne diseases – Functional design of water treatment plant – desalination plant- water distribution system – pipe network analysis- characteristics and composition of sewage - Planning and design of sewerage system - sewer appurtenances - Pumping of sewage - sewage treatment and disposal - Design of storm water drain- plumbing system in high rise building - industrial waste treatment - solid waste management – Air and Noise pollution control – E-Waste management.

#### **Unit VII: Design of Reinforced Concrete, Prestressed Concrete and Steel Structures (30 Questions)**

Design of concrete members - limit state and working stress design concepts - design of slabs - one way, two way and flat slabs - Design of singly and doubly reinforced sections and flanged sections -design of columns and footings – pre- stressing - systems and methods- post tensioning slabs - Design of pre-stressed members for flexure.

Design of tension and compression members - Design of bolted and welded connections design of members of truss - designs of columns and bases - design of beams, plate girders and gantry girder- design of liquid storage structures –elevated and underground- design of retaining wall.

#### **Unit VIII: Hydraulics and Water Resources Engineering (20 Questions)**

Hydrostatics-applications of Bernoulli equation – losses in pipes - flow measurement in channels - open channel flow- types of pumps and characteristics - Applications of Momentum equation, Kinematics of flow. Water resources in Tamil Nadu - Water resource planning - Master plan for water management - flood control – Runoff estimation – hydrograph – flood routing - Soil plant water relationship - Water requirement for crops - Irrigation methods – Design of alluvial canal and design of headworks. Water logging and land reclamation - cross drainage works.

#### **Unit IX: Urban and Transportation Engineering (20 Questions)**

Urbanization trend and impact - Slum clearance and slum improvement programmes - Different modes of transport and their characteristics. Geometric design of highways. – Pavement materials and testing – alternate pavement materials- modified binders - Design and Construction of bituminous and concrete roads – pavement distress and evaluation - Maintenance of roads – Railways - Components of permanent way - Signalling, Interlocking and train control - drainage in roads and railways. Airport planning - Components of Airport - Site selection – Runways – Planning of terminal buildings Harbours & Ports - Layout of a harbour - Docks - Breakwaters.

#### **Unit X: Project Management and Estimation (15 Questions)**

Construction management - Construction planning - Scheduling and monitoring - Cost control, Quality control and inspection - Network analysis - CPM and PERT -methods of project management - Resources planning and resource management - Types of estimates - Preparation of technical specifications and tender documents – e-tender - Building valuation - law relating to contracts and arbitration.

### **11. Computer Science, Information Technology, Electrical, Electronics and Communication Engineering (Degree Standard)**

**Code: 554**

#### **Unit I: Programming In C, Python and Object Oriented Programming (20 Questions)**

##### **C Programming:**

Data Types – Expressions – Input / Output Operations – Decision Making and Branching Statements – Looping Statements – Arrays – Initialization – Declaration – One dimensional and Two dimensional

arrays. String – string operations – String Arrays. Simple programs – sorting – searching – matrix operations – Function – Definition of function – Declaration of function – Pass by value – Pass by reference – Recursion – Pointers – Definition – Initialization – Pointers arithmetic - Pointers and arrays – structure data type – structure definition – Structure declaration – Structure within a structure – Union – Programs using structures and Unions – Storage classes, Pre-processor directives - File Handling

### **Python Programming:**

Python Interpreter and Interactive Mode-Data types-Statements- Expressions-Boolean Values and Operators-Strings-Arrays of Numbers- Lists-Tuples-Dictionaries-Functions-File Reading and Writing

### **Object Oriented Programming:**

C++ Programming features – Data Abstraction – Encapsulation – Class – Object – constructors – static members – constant members – member functions – pointers – references – Role of this pointer – Storage classes – function as arguments – String Handling – Copy Constructor – Polymorphism – compile time and run time polymorphisms – Function overloading – operators overloading – dynamic memory allocation – Nested classes – Inheritance – virtual functions. Abstract class – Exception handling – Standard libraries – Generic Programming – templates – class template – function template – STL - containers – iterators – function adaptors – allocators – Parameterizing the class – File handling concepts.

### **Unit II: Data Structures and Algorithms (20 Questions)**

List ADT – array based implementation – linked list implementation – singly linked lists – circularly linked lists – doubly-linked lists – applications of lists – Polynomial Manipulation – All operation (Insertion, Deletion, Merge, Traversal) – Stack ADT – Evaluating arithmetic expressions – other applications – Queue ADT – circular queue implementation – Double ended Queues – Priority Queues - application of queues – Trees: Binary Tree - Binary Search Tree-Tree Traversals –Operations- AVL Tree-Splay Tree-Red Black Tree- Binary Heap- Skew Heap- Leftist Heap - Binomial Heap-Fibonacci Heap- Sorting algorithms: Insertion sort – Selection sort – Shell sort – Bubble sort – Quick sort – Merge sort – Radix sort – Heap Sort - Searching: Linear search – Binary Search - Hashing: Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing – Graph Algorithms: Minimum Spanning Tree – Shortest Path Algorithms - Graph Traversals -Directed Acyclic Graph- Topological Ordering-All Pair Shortest Path Algorithms- Floyd Warshall algorithm- Bellman Ford Algorithm-Network Flow Algorithms- Ford Fulkerson Algorithm-Amortized Analysis of Algorithms - Algorithm Analysis: Asymptotic Analysis-Solving Recurrence Equations-Algorithm Design Techniques-Greedy Algorithms-Dynamic Programming-Divide and Conquer.

### **Unit III: Digital Logic and Computer Architecture (20 Questions)**

Boolean Algebra and Logic Gates – Combinational Logic – Sequential logic Functional Units of a Digital Computer - Arithmetic operations : Addition and Subtraction – Binary Multiplication – Binary Division – Floating Point Numbers – Addressing Modes - Instruction Set Architecture – RISC and CISC Architectures CPU Performance Metrics - Data path and Control – Hazards: Structural, Data and Control Hazards – Dynamic Scheduling – Speculation – ILP and Thread Level Parallelism – Memory Hierarchy – Cache Memories – Virtual Memory – Associative memories – Accessing I/O devices Interrupts - Direct Memory Access – Multicore Architectures – Open MP – MPI – Cache coherence policies – GPU architectures and programming.

### **Unit IV: Database Management Systems (20 Questions)**

INTRODUCTION TO DBMS – File Systems Organization – Sequential, Pointer, Indexed, Direct – Purpose of Database System – Database System Terminologies – Database Characteristics – Data models – Types of data models – Components of DBMS – Relational Algebra. LOGICAL DATABASE DESIGN: Relational DBMS – Codd's Rule – Entity – Relationship model – Extended ER Normalization – Functional Dependencies, Anomaly – 1 NF to 5 NF – Domain Key Normal Form – Denormalization. SQL & QUERY OPTIMIZATION – SQL Standards – Data types – Database Objects – DDL – DML – DCL – TCL – Embedded SQL – Static vs Dynamic SQL – QUERY OPTIMIZATION: Query Processing and Optimization – Heuristics and Cost Estimates in Query Optimization – TRANSACTION PROCESSING AND CONCURRENCY CONTROL – Introduction – Properties of Transaction – Serializability – Concurrency Control – Locking Mechanisms – Two Phase Commit Protocol – Dead lock – TRENDS IN DATABASE TECHNOLOGY – RAID – File Organization –

Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Object Oriented Database Management Systems- Object Oriented Relational Database management Systems

### **Unit V: Operating Systems and Cloud Technologies (20 Questions)**

OPERATING SYSTEMS OVERVIEW – Computer System Overview – Basic Elements, Instruction Execution, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview – objectives and functions, Evolution of Operating System – Computer System Organization – Operating System Structure and Operations –System Calls, System Programs, OS Generation and System Boot – PROCESS MANAGEMENT – Processes – Process Concepts, Process Scheduling, Operations on Processes, Interprocess Communication; Threads – Overview, Multicore Programming, Multithreading Models; Windows 7 – Thread and SMP Management. Process Synchronization – Critical Section Problem, Mutex Locks, Semaphores, Monitors; CPU Scheduling and Deadlocks – STORAGE MANAGEMENT – Main Memory – Contiguous Memory – Allocation, Segmentation, Paging, 32 and 64 bit architecture Examples; Virtual Memory – Demand Paging, Page Replacement, Allocation, Thrashing; Allocating Kernel Memory, OS Examples – I/O SYSTEMS – Mass Storage Structure – Overview, Disk Scheduling and Management; File System Storage – File Concepts, Directory and Disk Structure, Sharing and Protection; File System Implementation – File System Structure, Directory Structure, Allocation Methods, Free space Management; I/O Systems.

Cloud Technologies: Cloud Characteristics-Cloud Service and Deployment Models-Virtualization-Virtual Machines-Server, Network and Storage Virtualization-Hypervisor-Cloud Security Requirements-Threats: Malicious Attacks-Events and Alerts- Security Information and Event Management - Hadoop –Map Reduce Technique.

### **Unit VI: Software Engineering (20 Questions)**

Software Process and Project Management:

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models - Software Project Management: Estimation – LOC and FP Based Estimation, COCOMO Model – Project Scheduling – Scheduling, Earned Value Analysis – Risk Management – Introduction to Agility - Agile Process - Extreme Programming - XP Process - REQUIREMENTS ANALYSIS AND SPECIFICATION – Software Requirement: Functional and Non – functional, User requirements, System requirement, Software Requirements - Document – Requirement Engineering Process : feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management – Classical analysis: Structured system Analysis, Petri Nets – Data Dictionary - SOFTWARE DESIGN –Design process design Concepts – Design Model – Design Heuristic –Architectural Design – Architectural styles, architectural Design, Architectural mapping using dataflow – User Interface Design: Interface Analysis, Interface design – Component level Design: Designing Class based components, Traditional Components –TESTING AND IMPLEMENTATION –Software testing fundamental – Internal and external views of Testing – white box testing – basis path testing - control structure testing – black box testing – Regression Testing – Unit Testing – Integration Testing – Validation Testing – System Testing and Debugging – Software Implementation Techniques : Coding practices – Refactoring –PROJECT MANAGEMENT –Cost Estimation – FP Based, LOC Based, Make /Buy Decision, COCOMO II – Planning – Project Plan, Planning Process, RFP Risk Management – Identification, Projection, RMMM – Scheduling and Tracking – Relationship between people and effort, Task Set & Network, Scheduling, EVA – Process and Project Metrics - DEVOPS Essentials - Build Model Using MAVEN - Building DEVOPS using Azure.

### **Unit VII: Web Technology (20 Questions)**

SCRIPTING LANGUAGES –Web page designing using HTML, Scripting basics – Client side and server side scripting. Java Script – Object, names, literals, operators and expressions – statements and features – events – windows –documents – frames –date types –built-in functions – Browser object model – Verifying forms – HTML5 – CSS3 – HTML 5 canvas – Web site creation using tools – Event Handling- PHP Scripting - JAVA PROGRAMMING – Features of java – Data types, variables and arrays – Operators – Control statements – Classes and Methods – Inheritance. Packages and Interfaces – Exception Handling – Multithreaded Programming – Input / Output – files – Utility Classes – Strong Handling – JDBC – JDBC Overview –JDBC implementation – Connection class – Statements – Catching Database Results, handling database Queries. Networking –Inet Address class – URL class – TCP sockets – UDP sockets, Java

Beans –RMI – APPLETs – Java applets – Life Cycle of an Applet – Adding Images to an Applet – Adding Sound to an Applet – Passing Parameters to an Applet - Event Handling. Introducing AWT: Working with Windows Graphics and Text. Using AWT Controls, Layout Managers and Menus. Servlet – life cycle of a servlet. The Servlet API, Handling HTTP Request and Response, Using Cookies, Session Tracking - MVC Architecture – Nodejs - Events – Listeners – Timers - Callbacks – Handling Data - Implementing HTTP Service in Nodejs – NOSQL – MongoDB – Frameworks – SPRING – MERN – MEAN – Flutter

### **Unit VIII: Computer Networks and Security (20 Questions)**

NETWORKING FUNDAMENTALS & LINK LAYER –Building a network- requirements – Layering and protocols – Internet Architecture – Network software – Performance; Link layer Services – Framing – Error Detection – Flow control – MEDIA ACCESS & INTERNETWORKING – Media access control- Ethernet (802.3) – wireless LANs -802.11 – Bluetooth – switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP)- ROUTING – Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM) - TRANSPORT LAYER – Overview of Transport layer – UDP- Reliable byte stream (TCP) – Connection management – Flow control – Retransmission – TCP Congestion control – Congestion avoidance (DECbit, RED) – QoS – Application requirements – APPLICATION LAYER - Traditional applications - Electronic Mail (SMTP, POP3, IMAP,MIME) HTTP –Web Services - DNS –SNMP – Mobile Computing – Mobile Computing Vs. wireless Networking – Mobile Computing Application – Characteristics of Mobile Computing – Structure of Mobile Computing Applications. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes –MOBILE INTERNET PROTOCOL AND TRANSPORT LAYER – Overview of Mobile IP- Features of Mobile IP- Key Mechanism in Mobile IP – Route Optimization. Overview of TCP/ IP – Architecture of TCP/ IP – adaptation of TCP Window – Improvement in TCP Performance – MOBILE AD-HOC NETWORKS – Ad- Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols – Popular Routing Protocols – Vehicular AdHoc networks (VANET)- MANET Vs VANET – Security – Cryptographic Algorithms – Caesar Cipher – Hill Cipher – Vignere cipher – LFSR Sequences – Number Theory –GCD –Chinese Remainder Theorem – Fermat's Theorem and Euler's Theorem – Symmetric key Cryptography – DES – AES Algorithms – Public key algorithms – RSA – Diffe–Hellman Algorithm – ElGamal System – Elliptic Key Cryptography – Digital Signatures – Digital Certificates – Hashing – MD5 – SHA1 – Key Management – Kerberos –PKI –IP Security – Email Security – SSL – SET –OS Security – Database Security.

### **Unit IX: Microprocessor and Embedded Systems (20 Questions)**

8085 Architecture, Instruction set, addressing modes, Assembly language programming, Interrupts, timing diagrams, memory and I/O interfacing; 8086 Architecture, Instruction set, addressing modes, minimum and maximum mode configuration, assembler directives, assembly language programming, interrupts; 8051 Architecture, Special Function Registers (SFRs) instruction set, addressing modes, assembly language programming, I/O ports, Timers/counters, interrupts and serial communication.

Embedded System design process, Embedded processors – ARM Processor – Architecture, ARM Instruction sets – Addressing Modes – Pipelining – Embedded C Programming – Looping Structures – Register Allocation – Function calls – Pointer aliasing – Structure arrangement – bit fields – unaligned data and endianness – inline functions and inline assembly – portability issues. Profiling and cycle counting – instruction scheduling – optimized primitives. Multiple tasks and processes – Context switching – Scheduling policies – Interprocess communication mechanisms – Exception and interrupt handling – Performance issues. Meeting real time constraints – Multi-state systems and function sequences – Embedded software development tools – Emulators and debuggers.

### **Unit X: Electrical, Electronics and its Applications (20 Questions)**

Ohm's Law - Kirchhoff's Laws – Solution of DC circuits with Independent sources only (Steady state), AC Fundamentals: Waveforms, Average value, RMS Value, Impedance, Instantaneous Power, Real Power, Reactive Power and Apparent Power, Power Factor – Steady State Analysis of RL, RC and RLC Circuits- three phase circuits.

Magnetic Circuits– DC Machines: Construction, Working Principle, Types and Applications of DC Generator and Motor, EMF and Torque equation. AC Machines: Construction, Working and Applications of Transformer, Three phase Alternator, Synchronous motor, Single and Three Phase Induction Motor, stepper motor, servo motor and BLDC motor.

Operation and Characteristics of electronic devices: PN Junction Diodes, Zener Diode, BJT, JFET, IGBT and MOSFET– Voltage regulators - Operational Amplifiers - 555 timer IC based astable and monostable multivibrator.

Solenoids, electro-pneumatic systems, proximity sensors, limit switches, piezoelectric, Hall Effect, photo sensors, Strain gauge, LVDT, piezo electric crystals, differential pressure transducer, optical and digital transducers, Smart sensors, Thermal Imagers.

Moving Coil and Moving Iron Instruments, Power Measurement, Energy Meter, Instrument Transformers - CT and PT, Multimeter- DSO- Data Acquisition Systems – A/D and D/A Converters –Data Transmission Systems – smart meters.

Single and Three Phase AC to DC Converters – uncontrolled and controlled rectifiers– Switched Mode Power Supplies – buck, boost and buck-boost converter topologies –switching losses – Inverters – Single and Three Phase Inverters – Voltage control –Pulse Width Modulation techniques – harmonic elimination techniques – Uninterrupted Power Supplies- Batteries – types and characteristics.

## **12. Criminology, Forensic Science, Psychology and Philosophy (Degree Standard)**

**Code:571**

### **Unit I: Sociology and Psychology of Crime (20 Questions)**

Anomie – Merton and Durkheim, Culture Conflict, Sub-culture theories. Theory of Imitation – Gabriel Tarde, Differential Association Theory, Drift and Neutralisation Theory, Transition Criminology, on-set and Influence of Drugs and Alcohol on children behavior. Vagrant and Truant children – Legal controls. Victimless crimes: Alcoholism, Drug Addiction, Beggary, Commercial Sex, Suicide, Delinquency. Anti-social Behavior.

### **Unit II: Family centered & Community Influences - Crimes against children and women under Indian Law (20 Questions)**

Dowry, domestic violence, child abuse – Physical, Social, Sexual, Emotional and Neglect. Inter-religion and Inter-caste tensions and conflicts. Honour killing, Hate crimes and Blasphemy. Fundamental Rights under constitution of India. Rights of person in custody. The protection of Human Rights Act, Protection of Children from Sexual Offences Act (POCSO). The Immoral Trafficking Prevention Act, 1956 (Amended 2006) – Child Marriage Act.

### **Unit III: Women and Juvenile Institutions with relevant legislations and International Guidelines (20 Questions)**

Women Institutions: Vigilance Home, Protective Home children in conflict with law; children and vulnerability. Juvenile Justice Board, Child Welfare Committee, Observation Homes, Juvenile Justice (Care and Protection of children) Act, 2015. Juvenile Homes, Special Homes, Fit institutions, Juvenile Aftercare Services, Juvenile Police Unit, Probation of Offenders Act and Parole. 3-R's Rehabilitation of punishment, Reformation and Reintegration. United Nations Standard Minimum Rules for Juvenile Justice (Beijing Rules) and United Nations (Riyadh) Guidelines. Convention of the Rights of the Children, Prevention of Delinquency.

### **Unit IV: Crime Prevention and Victim Assistance (20 Questions)**

Crime prevention; Primary, Secondary and Tertiary. Neighborhood involvement, Situational crime prevention, crime prevention through Environmental Design and Defensible space. United Nation Declaration of Basic principles of Justice for victims of Crime and Abuse of power, 1985. Impact of victimization – Physical, financial and psychological resilience, post – traumatic stress, growth, anger and aggression management, Repeat victimization, routine activities theory, life style exposure. Restitution and Restorative Justice.

### **Unit V: Forensic Science and Toxicology (20 Questions)**

Forensic Science – Definition – Physical evidences – their classification and significance – Locard's Principle of Exchange

Toxicology – classification and mode of action of poisons – narcotic drugs – alcoholic beverages – Isolation and Identification of poisons, drugs and alcohol.

Drugs: Pharmacological actions, therapeutic uses and screening tests of the following drugs- opium alkaloids-morphine, heroin, antibiotics synthetic analgesics phenothiazines, meprobamate, diazepam pethidine, methadone barbiturates stimulants tranquilizers amphetamines, imipramines hallucinogens cannabinoids, LSD hypnosis and sedatives antipyretics, analgesic, antiseptics and disinfectants - Alcohol manufacture of ethyl alcohol and liquors constituents of liquors estimation of alcohol contents in liquors denaturation, denaturants, industrial alcohol and power alcohol.

Definition of poisons - Mode of action of poisons - Extraction and purification of poisons in toxicological analysis - Volatile poisons – metallic poisons - non-volatile organic poisons - water soluble compounds - protein precipitation methods. Estimation of the following poisons Carbon monoxide, cyanide, formaldehyde, methanol, chloral, chloroform, phenols, cresols, phosphorus and amphetamines Signs and symptoms of H<sub>2</sub>SO<sub>4</sub>, HNO<sub>3</sub>, CO<sub>2</sub>, H<sub>2</sub>S poisoning. Analytical methods for the estimation of ethyl alcohol. Metallic poison-signs, symptoms of arsenic, mercury, lead and copper - Reinch test - Marsch Berzelius and Gutzeit tests volumetric, colorimetric and instrumental methods of analysis of the above metals. Pesticides & Insecticides Definition - general properties poisonous nature - detection & isolation.

#### **Unit VI: Forensic Biology (20 Questions)**

Examination of biological fluids - blood, semen and saliva stains – forensic characterization of the above stains – stain patterns of blood - Examination of fibres, hair, bones, teeth and skull – Fundamentals of DNA Typing. Forensic Anthropology - Anthropometry and its uses - Biochemical and Molecular Techniques: Blood and its composition – WBC, RBC and Platelets. Blood clotting, Blood grouping - Antigens and Immunoglobins – Classes and functions. Collection and Preservation of Biological fluids [Blood, Semen and Saliva] - Isolation of DNA from blood sample, and DNA Typing - Ethnobotany – Ethno Medicinal Plant, Narcotic Plant

#### **Unit VII: Introduction to Psychology (20 Questions)**

Psychology – Branches - Biological Bases of Behaviour – Brain, Nervous System – Heredity – Environment – Developmental Stages – Childhood - Adolescence – Adulthood – Attention – Kinds of Attention – Perception – Illusion – Consciousness – Sleeping – Consciousness altering drugs – Memory – Memory Models - Types of memory – Forgetting – Thinking – Intelligence – Theories of Intelligence - Emotional Intelligence – Intelligent Quotient (IQ) - Creativity – Theories of Creativity – Motivation – Drives – Classification of Motivation - Motives – Affiliation – Aggression – Emotion – Biological Basis – Theories of Emotions.

#### **Unit VIII: Health, Social and Wellbeing Psychology (20 Questions)**

Health Psychology – Behavioural and Psychological correlates of illness – Stress and coping – Managing Stress – Personality – Types of Personality – Projective Techniques – Adjustment – Models of Adjustment - Mental Disorders – Abnormality – Diagnosis – Diagnostic and Statistical Manual of Mental Disorders (DSM) – International Classification of Diseases (ICD) – Anxiety Disorder – Mood Disorder – Dissociative and Somatoform disorders – Schizophrenia, Psychotherapies – Mental Hygiene - Yoga and Meditation – Social Behaviour – Prejudice – Social Influence – Prosocial Behaviour – Group – Group Behaviour – Inter group relation.

#### **Unit IX: Indian Philosophy (20 Questions)**

Heterodox: Carvaka – Epistemology, Metaphysics and Ethics; Jainism – Bondage and liberation, Triratna and Panchamaha Vratas, Sects of Jainism – Svetambara and Digambara; Buddhism – Four noble truths, Eight fold path, Sects of Buddhism – Hinayana and Mahayana.

Orthodox: Nyaya – Theory of knowledge; Vaishesika – Theory of Atomism; Samkhya – Theory of Evolution, Theory of Causation; Yoga – Astanga Yoga; Purua Mimamsa – Theory of Knowledge; Vedanta – Advaita – Maya, Brahman & concept of liberation; Visistadvaita – world, God and liberation; Dvaita – Doctrine of Panchabedha.

#### **Unit X: Logic and Ethics (20 Questions)**

- a Logic: Nature and classification of Terms and Propositions, Laws of Thought, Square of Opposition, Obversion & Conversion – Rules of Categorical Syllogism with fallacies; Mixed Syllogism – Hypothetical, Disjunctive and Dilemma. Difference between Deduction and Induction, Problems of Induction Stages of Scientific Induction, Characteristics of Hypothesis, Observation and Experiment.

- b Ethics: Rna – Rta; Karma; Purusharthas; Varnashrama Dharma; Ethics of Buddhism, Jainism and Bhagavad Gita.  
Hedonism, Utilitarianism of Bentham and J.S. Mill, Intuitionism of Butler, Kant's Categorical Imperative, Bradley's – My Station and its Duties.

### **13. Dairy Science, Dairy Technology, Food Technology, Food Processing (Degree Standard)**

**Code: 579**

#### **Unit I: Dairy Science (20 Questions)**

Status of Indian dairy industry- Operation flood program - Anand pattern - Milking systems – clean milk production - Milk composition and factors affecting composition of milk - Nutritive value - Platform tests, Adulteration of raw milk - Milk procurement and pricing policy - Operation and maintenance of primary milk co-operative society (PMCS) – milk analysers, estimation of milk fat and SNF –Chilling of raw milk and BMC operation - Milk transportation and surveillance system, Raw milk - FSSAI specifications.

#### **UNIT II: Processing of Fluid Milk (20 Questions)**

Unit Operations in Dairy Processing Plant: Homogenisation - Standardization of milk – Pearson square and algebraic methods - Thermal processing of milk - Defects in market milk - Manufacture of special milk: toned, double toned, reconstituted, recombined, flavoured, homogenized, vitaminised and acidophilus milk –Storage of raw milk and Processed milk. Manufacture of sterilized milk: UHT-Cleaning and Sanitation – CIP System - Distribution systems for market milk - Effect of heat processing on nutritive value.

#### **UNIT III: Fat Rich Dairy Products (20 Questions)**

Cream: Definition & Legal standards, efficiency of cream separation and factors affecting Cream separation – control off at percentage in cream - Neutralization, standardization, pasteurization and cooling of cream - Preparation and properties of different types of cream – sterilized cream, frozen cream - Factors affecting quality of cream - ripening of cream - Packaging, storage and distribution - defects in cream and prevention.

Butter: Theory of churning, legal standards - Technology of butter manufacture: batch and continuous methods - Over run in butter; control of fat loss in buttermilk - packaging and storage – transportation - defects in butter - rheology of butter - uses of butter. Care and maintenance of cream separator, coolers, vacreator, factory butter churn and continuous butter making machine. Special butter and related products: Manufacture, packaging, storage and properties of whey butter, flavoured butter, whipped butter, renovated butter/fractionated and polyunsaturated milk fat products, vegetable oil- blended products and low-fat spreads - Manufacture, packaging, storage and characteristics of margarine of different types.

Ghee and butter oil: Methods of ghee making: batch and industrial processes - innovations in ghee production - procedure, packaging and preservation of ghee – utilization of substandard milk –Composition of ghee and changes during manufacture - fat constants. Manufacture of butter oil - packaging and storage.

#### **Unit IV: Ice-cream and Frozen Desserts (20 Questions)**

Definition - classification - composition and standards of ice cream and other frozen desserts - calculation and figuring of ice cream mix and yield -Stabilizers and emulsifiers – classification, properties and role in quality of ice cream - Thermodynamics of freezing and calculation of refrigeration loads - Types of freezers - refrigeration control/instrumentation - Hygiene, cleaning and sanitation of ice cream plant - Effect of process treatments on the physico-chemical properties of ice-cream mixes and ice cream - Processing and freezing of ice-cream mix and control of over run - Packaging, hardening, storage and transportation of ice-cream - Defects in ice cream, causes and prevention.

#### **Unit V: Traditional Indian Dairy Products and Fermented Dairy Products (25 Questions)**

Khoa and Khoa based sweets: Peda, Burfi, Kalakhand, Gulabjamun and Milk cake - Compositional profile and manufacture process. Rabri and Basundi:Channa and Channa based sweets: Rasogolla, Rasomalai, Sandesh, Paneer. Chakkaand Shrikhand – Misti Dahi–Kheer, Payasam and kulfi.Bio preservative principles in enhancing the shelf-life of indigenous milk products –packaging.

Preparation of Dahi, Yogurt, Lassi, Buttermilk.Cheese Technology - Definition - standards and classification of cheese - Action of rennet on milk in relation to cheese making -Manufacture of different

varieties of cheese: Cheddar, Swiss, Mozzarella, Gouda and Cottage Cheese - Enzyme Modified Cheese (EMC) – flavourings - Application of membrane processing in cheese manufacture - Factors affecting yield of cheese – Packaging - storage and distribution of cheese –Accelerate ripening of cheese. Manufacture of processed cheese and cheese spread - Mechanization and automation in cheese processing.

#### **Unit VI: Condensed and Dried Milks (15 Questions)**

Condensed Milk: Definition and legal standards - Condensed milk, sweetened condensed milk and evaporated milk - manufacturing techniques - Recombined sweetened condensed milk - Grading and quality of raw milk for condensed and evaporated milk, physico-chemical changes taking place during manufacture of condensed milk - heat stability of milk and condensed milk and role of stabilizers in the stability of condensed milk - defects in condensed milk, causes and prevention.

Dried Milk: Grading and quality of raw milk for dried milks - Manufacture of whole milk powder (WMP), skim milk powder (SMP), and heat classified powders - composition of dried milks, recovery of milk powders- manufacture of infant foods, malted milk foods and other formulated dried products - Cheese spread powder, ice cream powder, cream powder, butter powder, whey powder.

#### **Unit VII: Dairy Chemistry (20 Questions)**

Milk Sampling Techniques from different sources for Chemical Analysis - Chemistry of Lactose, Significance of lactose in milk and milk products - Estimation of lactose in milk - Chemistry of Proteins- General description, amino acid contents of milk proteins, caseins, lactalbumins, lactoglobulins, other proteins in milk, physical and chemical properties of milk proteins, separation of milk proteins - Estimation of proteins in milk - Chemistry of Milk Lipids - General description, classification, distribution of lipids in milk, composition of milk, milk fat constants, phospholipids, unsaponifiable matter, milk fat hydrolysis, milk fat oxidation, hydrogenation of fat - Mineral constituents of milk.

#### **Unit VIII: Microbiology of Milk and Milk products (20 Questions)**

Common microbes in milk and their significance, Microflora of mastitis milk, Sources of microbial contamination of raw milk during collection, transport and storage; Microbial changes in raw milk during long storage, Microbiological grading of raw milk; Microbiological aspects of processing techniques - bacteriostasis, thermization, pasteurization, sterilization, boiling, UHT and non-thermal processes including membrane filtration; Role of psychrotrophic, mesophilic, thermophilic and thermotolerant bacteria in spoilage of processed milks, their sources and prevention; Microbiological quality of dairy products - fat rich, frozen, concentrated, dried milks, fermented, and indigenous dairy products; Legal standards; Sources of contamination and factors affecting microbial quality of these products during processing, storage and distribution; Microbiological defects associated with milk products and their control; Food poisoning; infections and their public health significance; Sources of pathogens and their prevention.

Environmentally transmitted microbial pathogens (*Salmonella*, *E. coli*, *Campylobacter*, *Yersinia* etc.) and viruses (enteric and respiratory); indicator microorganisms - total and faecal coliforms, faecal streptococci, bacteriophage etc; Biofouling and biofilms; microbial toxicants and bio-organic pollutants; Current trends in cleaning and sanitization of dairy equipment; Enumeration of composite microflora in milk and dairy products - aerobic & anaerobic; Quality requirements of water for dairy plant operations.

Principles of quality and safety functions in dairy processing unit; FSSAI - regulations and guidelines; ISO standards; principles of QMS and HACCP, SAFE, GMP, SSOP, FSMS, personnel hygiene and food handling in dairy industry; Bio-safety concepts - Sampling plan as per International council for microbiological standards for foods (ICMSF); Guidelines and specifications for different dairy foods as recommended by ICMSF, CODEX.

#### **Unit IX: Dairy Process Engineering (20 Questions)**

Canning, dehydration, freezing, freeze drying, fermentation, microwave, irradiation and chemical additives- Aseptic preservation, hurdle technology, hydrostatic pressure technology and microwave processing- Use of non-thermal technologies (microfiltration, bacteriostasis, ultra high voltage electric fields, pulse electric fields, high pressure processing, irradiation, thermosonication), alternate-thermal technologies (ohmic heating, dielectric heating, infrared and induction heating).

Refrigeration – principles - refrigeration effect – coefficient of performance – units of refrigeration - vapour compression system-different types Refrigeration components – compressor, condensers, evaporators,

expansion device – types, construction, principle and working- Refrigerants – properties – classification, nomenclature – comparison and advantages – alternate refrigerants – Azeotropes - vapour absorption system- Electrolux refrigerator –construction and principles -Cooling load estimation.

Fuels: Renewable energy sources:- Operation and maintenance of different types of boilers - Properties of steam - Use of steam tables and Mollier charts, Analysis of energy input in steam generation and heat gain insteam consumption. Steam generators - Introduction to Indian Boiler Regulation Act. Boiler Draught - Air Compressors.

### **Unit X: Dairy Process Equipment Design and Automation (20 Questions)**

Principles and design of shell and its component, stresses from local load and thermal gradient, mountings and accessories - Principles and design of fermenter vessel and design problems - Hazards and safety considerations - Principles and design of agitators and separators. Heat exchangers - Principles and design of shell and tube heat exchanger - plate heat exchanger - scraped surface heat exchanger - tubular heat exchanger - sterilizer and retort - single effect and multiple effect evaporators- rising film and falling film evaporators. Design of crystallizer, centrifugal separator, freezing equipment- Types of freezers – Principles and design of ice-cream freezers and refrigerated display system - Principles and design of tray dryer, tunnel dryer, vacuum dryer, spray dryer and freeze dryer- Principles and design of screw conveyor, bucket elevator and pneumatic conveyor - Principles and design of extruders - Cold and hot extruder design, single and twin screw extruder.

Machines for filling of liquid and wet products - to predetermined level and predetermined volume- filling of dry solids- by count- volume-weight - methods of wrapping and bagging -Form, fill and seal machines-various forms of packaging – Cartoning systems – Printing and Labelling – Container handling. CAS and MAP, shrink and cling packaging, vacuum and gas packaging - Aseptic packaging, Active packaging, Smart packaging, intelligent packaging - Retort packaging, principles, application.

Dairy plant automation –principles- role of programmable Logic controller (PLC) and Supervisory control and Data Acquisition (SCADA)-automation tools-sensors-flow meters-actuators-and robotic system.

## **14. Electrical, Electronics and Communication Engineering (Degree Standard)**

**Code: 514**

### **Unit I: Circuit Theory, Signals and Systems (20 Questions)**

Circuit analysis: Kirchoff's laws, Nodal and Mesh analysis, Network Theorems: Superposition, Thevenin, Norton, Miller and Reciprocity. Sinusoidal steady state analysis: phasors, complex power, maximum power transfer. Time and frequency domain analysis of linear circuits: RL, RC and RLC circuits, solution of network equations using Laplace transform. Linear 2-port network parameters, Star-Delta transformation. Three Phase Circuits – Star-delta transformation - Real and reactive power - power factor Characteristics and classifications of Continuous and Discrete Time signals - CT signal analysis - Fourier Series, Fourier Transform and Laplace Transform. Sampling theorem, Discrete Time signal analysis - DTFT and Z-Transform. CT and DT systems - Impulse response and convolution, Frequency response, Transform domain analysis using FT, LT - Recursive and non-recursive systems.

### **Unit II: Analog and Digital Electronics (20 Questions)**

Semiconductor Devices: PN Diode, Zener, LED, Photo diodes, Transistors, FET and their applications. Rectifier circuits, Voltage regulators, Biasing circuits, Small signal amplifiers, Frequency response, Multistage amplifiers, Coupling methods, Large signal amplifiers, Push, pull amplifiers, Feedback amplifiers, Oscillators, Operational amplifiers and its applications, Precision rectifiers, Multivibrators, Schmitt triggers, Voltage Controlled Oscillator, 555 Timer.

Number representations: Binary, Integer and Floating point numbers, Boolean algebra, Minimization of functions using Boolean identities and Karnaugh map. Digital logic gate families (DTL,TTL,ECL,MOS,CMOS), Logic gates, Simplification of Logic Functions, Design of Combinational circuits, Sequential logic circuits, latch, Flipflops, Counters, Registers, multiplexers and demultiplexers, Memories(ROM,PLA and FPGA).

### **Unit III: Electromagnetic Theory (20 Questions)**

Coulomb's Law-Electric Field Intensity-Electric Flux Density-Gauss's Law- Divergence - Electric Field and Potential due to Point, Line, Plane and Spherical Charge Distributions - Effect of Dielectric Medium -

Capacitance of Simple Configurations- Magnetic Circuits- Magnetomotive force - Reluctance-Faraday's laws-Lenz's law-Biot-Savart's law - Ampere's law - Fleming's Left and Right Hand Rule-Lorentz force - Inductance - Self and Mutual Inductance-Dot Convention-Coupled Circuits  
Maxwell's equations, Poynting vector. Plane waves and properties: Reflection and refraction, Polarization, Phase and group velocity, Propagation through various media, Skin depth. Transmission lines: Equations, Characteristic impedance, Impedance matching, Impedance transformation.

#### **Unit IV: Electrical Machines (20 Questions)**

D.C. Machines - Construction, Excitation methods - Armature Reaction and Commutation - Characteristics and Performance Analysis - Generators and Motors - Starting, Speed Control and braking - Testing - Losses and Efficiency. Transformers – Types - Construction and Operation – Testing - Equivalent Circuits - Losses and Efficiency - All day efficiency - Regulation - Parallel Operation - Three Phase Transformers - Auto-transformer. Induction Machines - Construction, Principle of operation - Rotating Magnetic Field - Performance, Torque-Speed Characteristics, No-load and Blocked Rotor tests, Equivalent Circuit, - Starting, Speed Control and braking. Single Phase Induction Motors - Linear Induction Motors - Hysteresis Motors - Reluctance Motors. Synchronous Machines – Construction - Operating characteristics and Performance analysis - Efficiency and Voltage regulation - Parallel operation - V and inverted V curves of synchronous motors - Power factor improvement - permanent magnet synchronous motor - Permanent magnet brushless dc motor - stepper motor.

#### **Unit V: Control Systems (20 Questions)**

Mathematical Modelling of Physical Systems - Transfer Function - Block Diagrams and Signal Flow Graphs and their Reduction using Mason's Rule - Time Domain and Frequency Domain Analysis of Linear Time Invariant (LTI) System - Errors for Different Type of Inputs and Stability Criteria for Feedback Systems - Stability Analysis Using Routh-Hurwitz Array - Nyquist Plot and Bode Plot - Root Locus - Gain and Phase Margin - Basic Concepts of Compensator Design - PI, PD and PID Controllers - State Variable formulation - state transition matrix - Eigen values and Eigen vectors - free and forced responses of Time Invariant systems - controllability and observability.

#### **Unit VI: Power Systems (20 Questions)**

Single Line Diagram of Power System - Per Unit Quantities - Power Generation Types - Hydro, Thermal and Nuclear Stations - Pumped storage plants - Cogeneration - Economic and operating factors - Modelling and performance characteristics of Power transmission lines and Cables - Mechanical Design of Transmission Lines – Sag - Insulators - $Z_{Bus}$  and  $Y_{Bus}$  formulation - Load flow studies - Shunt and Series Compensation - Symmetrical and Unsymmetrical Fault Analysis - Transient and Steady - State Stability of Power Systems - Equal Area Criterion - Voltage and Frequency Control-Power System Transients - Power System Protection - Circuit Breakers - Relays classification of protection schemes -overcurrent, distance, differential and carrier - Equipment protection - transformer, generator, motor, busbars and transmission line – earthing and lightning protection - AC and DC Distribution – deregulation - energy conservation and energy auditing

#### **Unit VII: Measurements and Instrumentation (20 Questions)**

Units and Standards - Static and Dynamic Characteristics - Types of Errors - Error Analysis -Measurement of Current, Voltage, Power, Power-factor and Energy - Indicating instruments - Measurement of Resistance, Inductance, Capacitance and Frequency - Bridge Measurements - Instrument Transformers - Electronic Measuring Instruments - Multi meters - True RMS meter - Spectrum Analyzer -Power Quality Analyser - Recording Instruments-X-Y Recorder - Magnetic Recorders - Digital Data Recorder – Oscilloscopes – DSO - LED and LCD Display –Sensors and Transducers and their applications to the Measurement of Non-Electrical Quantities like Temperature Pressure, Flow-rate, Displacement, Acceleration, Noise level, Fire and smoke deduction - Data Acquisition Systems – A/D and D/A Converters - Data Transmission Systems - PLC -smart meters.

#### **Unit VIII: Digital Processors, Communication and Networks (20 Questions)**

Architecture of 8085, 8086 and 8051 – Instruction Sets – Assembly Language Programming – Interfacing for memory and I/O: 8255 Programmable Peripheral Interface – 8253 Programmable Timer Interface – 8279 Programmable Keyboard and Display Interface – 8257 Direct Memory Access Interface - Embedded processors (ARM and PIC basics only). Classification of Signals and systems – Properties of

Discrete Fourier Transforms - FFT Computation – FIR Filters – IIR Filters: Butterworth Filters – Chebyshev Filters.

Analog and Digital Communication Systems: AM/FM Modulation and Demodulation, ASK, FSK, PSK, PCM – Adaptive Delta Modulation – FDM and TDM – OSI MODEL, TCP/IP reference model, Data link layer, Medium Access Control, Network layer.

#### **Unit IX: Power Electronics and Drives (20 Questions)**

Static and dynamic behaviour of Power Semiconductor devices - Power Diode, DIAC, SCR, TRIAC, GTO, MOSFET and IGBT - Single and Three Phase AC to DC Converters - uncontrolled and controlled rectifiers - performance parameters - Switched Mode Power Supplies - buck, boost and buck-boost converter topologies - Switching losses – Inverters - Single and Three Phase Inverters - Voltage control - Pulse Width Modulation techniques - harmonic elimination techniques – AC voltage controllers- Uninterrupted Power Supplies - Electrical drives - motor load dynamics - load torque characteristics - Speed Control of DC Drives - Converter/Chopper fed dc motor drives - Speed control of AC drives - induction motor drives - stator voltage control and V/f control - synchronous motor drives -V/f control, self control, margin angle control and power factor control

#### **Unit X: Renewable Energy Sources, Storage Devices and Utilisation of Electrical Energy (20 Questions)**

Renewable Energy – Sources and Features - Solar Radiation Spectrum - Radiation Measurement - Solar Photovoltaic Cell – principle of operation –types - MPPT – Microhydel - Operating principle - Wind Energy – components - wind power turbine types - MPPT- Site Selection - Types of Wind Generators - smart grid - Electric vehicles - V2G and G2V - Fuel Cells - Batteries - types and characteristics - Super Capacitors Electrical wiring – illumination - design of lighting schemes - air conditioning system

### **15. Environmental and Chemical Engineering (PG Degree Standard)**

**Code: 393**

#### **Unit I: Environmental Policy, Environmental Legislations and Environmental Impact Assessment (25 Questions)**

National Environment Policy - International Conventions and Obligations, International treaties of Environment-Water (P&C) Act, 1974 as amended - Air (P&C) Act, 1981 as amended - Environmental Protection Act, 1986 with amendments and Rules and Notifications made under Environmental (Protection) Act, 1986 for the management of hazardous waste, solid waste, e-waste, bio-medical waste, plastic waste, C & D wastes, battery waste etc., EIA - Notification, Methodology, models, Environmental Monitoring and Management Plan, Public consultations as per EIA Notification.

#### **Unit II: Environmental Chemistry and Environmental Microbiology (15 Questions)**

Chemical mass balance – Emission calculations – Green Chemistry principles –Aquatic Chemistry - Atmospheric Chemistry and Soil chemistry – Representative sample collection techniques- Field and lab analysis - Wet and Instrumentation Methods - Chemical speciation, Classification and Characteristics of microorganisms - Microorganisms in wastewater and air - Applications of microorganisms in wastewater treatment and soil remediation.

#### **Unit III: Principles & Design of Physico-Chemical treatment of Wastewater (20 Questions)**

Water Quality criteria and indices - Wastewater characteristics - Unit operations - Principles and design of screens, grit chamber, skimming tanks - Flow equalisation and neutralisation - Aeration and gas transfer mechanisms – Sedimentation -Types of settling – analysis and Design of Sedimentation tanks - Process and design of filtration systems - Adsorption, ion exchange, electro-coagulation, Electrodialysis, reverse osmosis – RO reject Management - Disinfection.

#### **Unit IV: Principles and Design of Biological Treatment of Waste water (25 Questions)**

Types of Reactors - Mass Balance Analysis - Reaction and Reaction rates - Suspended growth process - Role of microorganism - Growth kinetics, oxidation, modelling, mCRT, F/M Ratio, Bio kinetic coefficients - Design of activated sludge process, Plug flow Reactor, Aerated lagoon - Oxygen Requirement, transfer of

oxygen, Equipments- Secondary clarifier, Sludge Volume Index, Sludge production, Operation and maintenance, Attached growth process - Trickling filter - process, substrate removal, classification, design, NRC, Rankine's and Eccenfelder equation - Rotating Biological contactors - UASB - Sludge digestion - sludge management – Advanced Biological Treatment – SBR, MBR, ANSBR.

#### **Unit V: Air and Noise pollution Control (15 Questions)**

Sources and Effects– Classification-Photochemical reactions, Atmospheric Stability-Lapse Rates, Inversions, Plume Behaviour -Pollutant Dispersion, Emission Standards and Air Quality Standards, Air Quality Index, Methods of Pollutant Sampling and Measurement, Continuous emission and Air Quality monitoring. Control Methods for Particulate Emissions, Black carbon and Gaseous Pollutants; Indoor Air Pollution, Automobile Pollution-Emission Norms and Control Techniques, Source apportionment studies, Noise Pollution – Source – Effects – Standards - Measurement and Control Measures - Industrial Noise Measurement and control.

#### **Unit VI: Solid and Hazardous Waste Management (25 Questions)**

Sources, generation rate, classification and characteristics - source segregation and storage - methods of collection - transportation - route optimisation – treatment –Incineration, Pyrolysis, Composting, MBT and Landfilling, Bioremediation ,Bioaccumulations - disposal – Coprocess - Centralised and de-centralised processing - Landfill design and operation - Dumpsite rehabilitation, Management of hazardous waste, biomedical waste, plastic waste, construction and demolition wastes and E waste - Resource recovery, recycle, reuse and product development from waste.

#### **Unit VII: Statistical Approach and Modelling of Environmental Systems (15 Questions)**

Principles of Environmental modelling, Statistical approach, model building, environmental models, Data Sampling – Distributions – Inference - Estimation – Hypothesis Testing, Calibration, Validation, and Sensitivity Analysis. Types of air quality models-dispersion and emission models, chemical and ecological models, Pollutant and nutrient dynamics. Operational control of wastewater treatment processes, microbial dynamics calculations, Surface and ground water Modeling.

#### **Unit VIII: Industrial Pollution Prevention and Cleaner Production Technologies (25 Questions)**

Industrial Manufacturing process description, Wastewater Characteristics, Source reduction, Treatment and disposal, key issues emerging contamination and pollution control measures for highly polluting industries such as Paper and Pulp, Sugar, Distillery, Chemical plants - Metal finishing, Iron and Steel, fertilizer, Meat packing, Poultry plant - Automobile - Thermal power plants, Cement Plants, Textile dying, Tanneries, Pharmaceutical, pesticides, petroleum refinery and petrochemicals - Integrated Waste Management for zero discharge, Cleaner production process including process modification, raw material substitution - Recycle and reuse of waste.

#### **Unit IX: Environmental Safety and Risk Assessment (15 Questions)**

Health and Safety systems in work places. Hierarchy of control measures for occupational health risks. Accident, causes, mechanical and electrical hazards and preventive steps. Role of personal protective equipment and the selection criteria. Significance of human factors in the establishment emergency preparedness. Qualitative and quantitative risk assessment- Hazard identification and control, Hazard assessment, Overall risk contours for different failure scenarios – disaster management plan – Safety measures design in process operations. Ergonomics effects on humans. Inspections and audits, safety policies, EHS issues.

#### **Unit X: Sustainable Development, Environmental Management and Economics and Global, Regional and Local Environmental Issues (20 Questions)**

Sustainable Development Principles - International Conventions and treaties-Sustainable Development Goals and Indicators, Environmental Management Systems – ISO 14001, 19000 - Environmental Auditing – Ecolabelling- Life cycle Assessment-Design for Environment, Economics of pollution prevention - Cost Benefit Analysis - Circular economy - Economic instruments for environmental protection - Pollutant tax and emission trading - Natural resource economics, Green building concepts.

## 16. Environmental Science, Biology and Chemistry (PG Degree Standard)

Code: 557

### Unit I: Introduction to Environment (30 Questions)

Environment: Components – Segments – Atmosphere: Troposphere – Stratosphere – Mesosphere – Thermosphere – Lithosphere: Crust – Mantle – Core – Hydrosphere: Fresh water and saline water – Biosphere – Ecology: Autecology – Synecology – Ecosystem: Structure and Function – Energy Flow – Food Chain – Food web – Ecological pyramids – Biogeochemical cycles (C,N, P, S and water) - Ecological successions: Primary and Secondary succession – Ecological interactions: Symbiosis - Commensalism – Mutualism - Proto-cooperation – Amensalism – Predation – Parasitism – Natural resources: Classification-renewable and non-renewable - Status and challenges. Water resources: Types – Availability – Issues - Conflicts over water. Soil and mineral resources - Mineral exploitation and Environmental impacts; Forest resources. Energy resources: Conventional and Non-conventional energy - Sustainable development: Sustainable Development Goals (SDGs)

### Unit II: Environmental Pollution and Management (30 Questions)

Pollution – Pollutant – Contamination – Contaminant - Point and non-point sources. Air pollution: Sources - Primary and secondary pollutants - Criteria pollutants – VOCs – PAN - PAHs - POPs - Acid rain – Smog – Oxidizing - Reducing. Air Pollution dispersion models: Looping – Coning – Lofting – Trapping - Indoor air pollution –Effects. Control Measures: Scrubbers – Wet – Dry – Venturi – Filter – Bag filters – Dehumidifier- Electrostatic precipitators (ESP) – Flue Gas Desulfurization (FGD). Cyclonic separators – Catalytic converter. Noise pollution: Sources – Effects – Control measures. Water pollution: Sources – Effects – Eutrophication – Biomagnification – Bioaccumulation – Control Measure – Waste water treatments – Primary – Secondary –Tertiary – Common Effluent Treatment Plant (CETP) – Sewage Treatment Plant (STP) – Constructed Wetlands. Soil pollution: Sources – Effects – Control measure – Bioremediation – Microbial remediation – Phytoremediation - Heavy Metal Pollution – Hg - Cr – As – Se – Cd - Pb - Sources – Effects - Thermal and Radioactive pollution - Municipal solid waste - Hazardous waste – Biomedical waste – Effects - Control measures – Incineration – Pyrolysis - Gasification – Composting – Ecotoxicology: Toxicant – Toxicity – Acute – Subacute – Chronic - Dose descriptor – LD50 – LC50 – NOAEL- Dose response relationship- Fate of Chemical in environment: Insecticides Fungicides – Herbicides – Fertilizers – PCB - Dioxins. Land degradation- deforestation- desertification – urbanization- Ozone layer depletion – Greenhouse Gases and Climate change – Meteorological indicators - Remote Sensing and GIS for environmental Management – National river conservation plan – Carbon sequestration and carbon credits.

### Unit III: Environmental Legislation, Policies and Standards (25 Questions)

Introduction to environmental laws - Constitutional provisions- Article 48A, Article 51A (g) – Article 21- Major Indian Environmental Legislations: Water Act - Air Act - Environment Protection Act – Environmental Protection Rules - Noise Pollution Rules – Biodiversity Act - Plastic and Solid waste management Rules – National Green Tribunal Act – Bio Medical Waste Management Rules – The E- Waste Management Rules – Hazardous and Other Wastes(Management and Transboundary Movement) Rules- Environmental Impact Assessment Notification – Coastal Regulation Zone Notification. Central Pollution Control Board (CPCB) - Environmental standards – Drinking water standards (IS 10500:2012)- Discharge of Industrial Effluents into inland – Public sewers – Irrigation – Marine – Standards for sewage treatment plants – Designated best use water quality criteria. National Ambient Air Quality standards – Noise standards - National Green Tribunal – Environmental Impact Assessment: Screening- Scoping- Public consultation – Methodologies – Environmental management plan- ISO 14000 series – Life cycle assessment – Occupational health and safety: Preventive measures – Health screening measures.

### Unit IV: Instrumentation and It's Applications (30 Questions)

Basic Principles, Instrumentation and applications of Ultraviolet-visible (UV-vis.) spectroscopy; Beer-Lambert's law, solution preparation and small molecules analysis and Flow Injection analyzer - Fourier Transformer Infrared spectroscopy (FT-IR): sample preparation - functional group analysis, Flame spectrometry, Atomic Absorption Spectroscopy (AAS), Inductively Coupled Plasma - Mass Spectrometry (ICP-MS), Inductively Coupled Plasma Emission spectroscopy (ICP-OES), Fluorimetry – Chemiluminescence's Detector system, X-ray fluorescence spectroscopy (XFS), Microscopy techniques: (fundamentals only) Optical microscopy, Scanning Electron Microscopy (SEM). Transmission Electron

Microscopy (TEM).

Chromatographic Techniques: Basic Principles, Instrumentation and applications of chromatography – Paper chromatography, Thin layer chromatography (TLC), High-performance Liquid chromatography (HPLC) and Gas chromatography (GC), Gas-Chromatography with Mass Spectrometry (GC-MS).

Electrochemical Techniques: Basic Principles, Instrumentation and application of conductometry, potentiometry – Ion selective meter – Voltammetry – Turbidimetry and nephelometry, Elemental analyzer, TOC analyzer, Portable Gas analysis, ambient air quality H<sub>2</sub>S, CO<sub>2</sub>, SO<sub>2</sub>, NO<sub>2</sub>, NH<sub>3</sub>, O<sub>3</sub>, HC Particulate analysis, Stack monitoring, Volatile organic Carbon (VOC).

#### **Unit V: Analytical chemistry (30 Questions)**

Titrimetric Analysis: Classification of reaction in titrimetric analysis – Standard Solutions – Normality, Molarity and Molality - concentration units – Primary and Secondary standard – neutralization indicators – self indicators and external indicators- acid base titrations – precipitation titrations – redox titrations.

Principles of gravimetric analysis – choice of precipitants and condition of precipitation, specific and selective precipitants – Dimethyl glyoxime (DMG), cupferron, phenolphthalein, salicylaldehyde, ethylene diamine – Co-precipitation and post precipitation.

Sampling techniques and procedure for solids, effluent, water and air - Physical evaluation of water; color, odour and turbidity. Chemical examination of water; alkalinity, Total Dissolved Solids (TDS), turbidity and total hardness. Determination of carbonates, bicarbonates, sulphates, chlorides, nitrates, phosphate, fluorides – sodium, potassium, SAR, iron, manganese, cadmium, chromium, lead, mercury and arsenic – oil and grease. Biological evaluation of water; dissolved oxygen, biological oxygen demand, chemical oxygen demand - organic pollutant and microbiological analysis.

#### **Unit VI: Environmental Biology (10 Questions)**

Physiology: Water relations of plants, Ion Transport, photosynthesis, Photolysis of water, Carbon fixation in C<sub>3</sub>-C<sub>4</sub> cycles, Biological Nitrogen fixation, Stress physiology (Biotic and Abiotic), Photochemical reactions, Oxidative Phosphorylation. Biodiversity - Biodiversity and its distribution; Levels and types; Hotspots; Biodiversity loss - Threats to biodiversity - In-situ and ex-situ conservation approaches - Biosphere reserves – MAB program - Pollution indicator organisms and adaptive mechanisms in invertebrates, fishes, amphibians, reptiles and birds. Biophysics: Laws of Thermodynamics, Energy transduction in biological systems. Migration of fishes, birds and mammals. Endangered and extinct species - current status – IUCN Red list category.

#### **Unit VII: Biochemistry Aspects of Pollution (10 Questions)**

Introduction to Pollution and Biochemistry: Disruption of Biochemical Pathways by Pollutants. Carcinogens and Environmental Pollution: Definition and Types of Carcinogens, Mechanisms of Carcinogenesis - Oxidative Stress, Common Environmental Carcinogens. Biochemical Markers for Carcinogenesis: Asbestos Toxicity - Heavy metal toxicity: Lead, Cadmium, Mercury, Arsenic and their Biochemical Effects - Mechanisms of Toxicity: Free Radicals, Oxidative Stress, Antioxidants. Role of Blood Tests in Detecting Pollutant Exposure: Effect of pollutants on human health. Pathways for Detoxification: Phase I and Phase II Detoxification.

#### **Unit VIII: Environmental Microbiology (15 Questions)**

Environmentally transmitted Microbial Pathogens (*Mycobacterium tuberculosis*, *Streptococcus pyogenes*, *Salmonella typhi*, *E.coli*, *Vibrio cholerae*, *Clostridium botulinum*), Viruses (Enteric and Respiratory), Indicator Microorganisms – Total and Faecal Coliforms, Faecal Streptococci. Biofouling and Biofilms; Microbial toxicants (Tetanus toxin, Botulinum toxin), Aflatoxin, Waste water treatment (Aerobic and anaerobic) – Waste conversion using microorganisms - Biofertilizer – Important plant diseases caused by Bacteria, Mycoplasma, Virus, Fungi and Nematodes – Biocontrol agents – Integrated pest management. Microbial Biotechnology – Fermentation technology – fermentation as a biochemical process – Bioconversion: Production of Alcoholic beverages, Antibiotics, Amino acids, Vitamins and Organic Acids – Single Cell Protein production (SCP).

#### **Unit IX: Marine Environment (15 Questions)**

Fundamentals of marine biology: Physical chemical properties of seawater-Chemical Properties-Vertical stratification- horizontal stratification of marine ecosystem-Marine Ecosystems: coastal; pelagic; and estuaries; deep sea; coral reefs; mangroves; sea grass meadows. Microorganisms; invertebrates;

vertebrates; marine plants; Turtles seabirds and marine mammals. Marine protected areas; conservation strategies; IUCN categories. Human Impacts, disaster and its management: sea ranching; Artificial reef. Marine Pollution and management: point and non-point source pollution; oil pollution; plastic pollution; microplastic pollution; heavy metal pollution; nutrient pollution, pesticide pollution; PHC pollutions, thermal pollution, nuclear pollution ballast waters and its impact.

### **Unit X: Biostatistics (5 Questions)**

Biostatistics: Sampling techniques, Central Values (Mean, Mode, Median), Dispersion: absolute relative probability: Binomial Properties, Problems, Fitting Positions, Normal, Skewness, Kurtosis, Correlations and Regressions - Simple Linear Testing – large sample. T-test, Chi square Test – Two-way ANOVA Experimental Design – Principles. CRD, RBD, LSD, Missing Plots – Figurative Representation (Bar diagram, Pie chart etc.).

## **17. Evaluation and Applied Research (PG Degree Standard)**

**Code: 607**

### **Unit I: Economics (20 Questions)**

Indian Economy– Economic Growth and Development: Concepts, distinction between the two, and contemporary measures (GDP vs. GVA, HDI, Gender–related Development Index, Multidimensional Poverty Index) – National Income Accounting: Concepts of GDP, GNP, NNP, NDP, Per Capita Income, methods of calculation, and recent estimates – Planning in India: Evolution from the Planning Commission to the role and functions of NITI Aayog; transition from central planning to indicative planning and cooperative federalism – Inclusive Growth: Concept, issues, strategies, and the role of social welfare schemes and government programs – Sustainable Development: Concepts, relevance of Sustainable Development Goals (SDGs), climate finance, and environmental policies – Sectoral Trends and Structural Changes – Agricultural – growth and development – green revolution – Industry – Industrial Policy changes and their effects on growth. Role of Public Sector –(disinvestment, privatization) and MSMEs – problems, government support – Investment Models: Public–Private Participation (PPP), National Infrastructure Pipeline (NIP), and National Monetisation Pipeline (NMP) – Infrastructure: Focus on new–age infrastructure (energy, transport, logistics, digital and National Bank for Financing Infrastructure and Development (NaBFID) – FDI: Trends, policy liberalization, and "Make in India" initiatives.

Service Sector: Types of services, changing sectoral contributions, and the role of IT/ITES. Labour: Skilled, semi–skilled, and unskilled labour dynamics; integration of e–Shram portal and new labour codes/laws. Human Development: Concepts, trends, issues, health – Public Health, National Health Mission, education, drinking water and sanitation, housing, nutrition, and social sector initiatives – Employment, Unemployment, and Underemployment: Concepts, measurement (Labour Force Participation Rate, Worker Population Ratio), and recent trends (Periodic Labour Force Survey data). Employment in organized and unorganized sectors (informalization of the workforce). Strategies for Employment Generation and skill development programs (PMKVY). Poverty: Concepts, measurement (Tendulkar and Rangarajan committees), trends, and poverty alleviation programs (MGNREGA) – Fiscal Policy and Budgeting: Union Budget, recent trends, fiscal consolidation path. FRBM Act (Fiscal Responsibility and Budget Management Act) and its review/current status. Taxation: Goods and Service Tax (GST), tax administration reforms, and fiscal federalism (role of the Finance Commission). Parallel economy in India (Black Money). Inflation and Definition: trends, estimates, consequences, and remedies. Wholesale Price Index (WPI) vs. Consumer Price Index (CPI) as primary inflation measures (focus on CPI for policy) – Monetary Policy and Banking: RBI (functions, autonomy debate) and the Monetary Policy Committee (MPC) framework for inflation targeting. Monetary policy tools (Repo, Reverse Repo, CRR, SLR, MSF, OMO, MCLR, etc.). Banking Sector Reforms – Non–Performing Assets (NPAs) resolution (IBC, Bad Bank concept – NARCL), Public Sector Bank consolidation/recapitalization, and financial inclusion initiatives. Digitalization of Finance: Unified Payments Interface (UPI), Payment Banks, Small Finance Banks, and FinTech developments – External Sector and Global Linkages – India's Foreign Trade – Composition, direction, and recent changes in trade policy – trade agreements (FTAs). Balance of Payments (BoP): Current and Capital Account components, change rate management (fixed vs. flexible, NEER/REER). Global Financial Crisis: Impact on India and lessons learned. International Economic Organizations: India and WTO requirements (subsidies, IPR issues like TRIPS, TRIMS, GATS), IMF, World Bank, BRICS.

## Unit II: Econometrics (20 Questions)

Definition and methodology of Econometrics. Data types and Structure: Cross-section, time-series, and panel data. Definition and Measurement of variables – Measurement scales of variables – Ratio, interval, ordinal, and nominal scales. Correlation: Simple and multiple correlation – Karl Pearson's correlation coefficient and Spearman's rank correlation coefficient. Regression Analysis (Simple and Multiple): Ordinary Least Squares (OLS) Principle and Properties of regression coefficients (Gauss–Markov theorem and BLUE – Best Linear Unbiased Estimators) – Coefficient of Determination –  $R^2$  and adjusted  $R^2$  Assumptions of Classical Linear Regression Model (CLRM): linearity, exogeneity, homoscedasticity, no-autocorrelation and normality of errors. Functional Forms of regression models: Log-linear – double-log, Semi-Log models – Elasticity and Growth Rate computations. Violation of Assumption of CLRM: Heteroscedasticity, Multicollinearity, Autocorrelation – Definition consequences and Remedial Measures. Dummy Variables and Qualitative Response Regression Models: Linear Probability Model (LPM), Logit and Probit Models – Binary, ordinal and Multinomial – Odds ratios and Marginal effects – Interaction effects – cautions of using dummy variables – Dummy variable trap. Basics of Time-Series Analysis and Forecasting: Time-Series Decomposition – Components of Time series data – Stationarity of Time Series data – Tests of Stationarity – Unit Root Test – Dickey–Fuller (DF) and Augmented Dickey–Fuller (ADF) test, Phillips–Perron (PP) test – Methods of time series forecasting : AR, MA, ARMA, and ARIMA models – Box–Jenkins Methodology (identification, estimation, diagnostic checking and forecasting). Simultaneous Equation models: Methods of Indirect Least Squares model and Two Stage Least Squares. Panel Data Models: Fixed effect model and Random affect model.

## Unit III: Statistics (20 Questions)

Compilation and Tabulation of data Collected – Classification – Types of Classification – Formulation of discrete and continuous frequency distribution (uni-variate and Bi-variate). Pictorial Representation of data: Bar diagrams – Pie diagrams – Histogram – Ogives and Lawrence Curve Measures of Location – Mean, Median, Mode, Harmonic Mean and Geometric Mean – Quartiles – Measures of variation: Range, Quartile deviation, Mean deviation, Variance and Standard deviation. Coefficient of variation, skewness and Kurtosis. (All the calculation of measures are for both grouped and ungrouped data) – Moments (raw and central) – outlier detection. Probability and Distribution: Introduction to probability: Random Experiments, Sample Space and events, Definition of probability. Classical, Empirical and Axiomatic approach to probability; Addition and Multiplication Theorem, Conditional probability and Baye's Theorem. Random Variables and Distribution function – Mathematical Expectation and conditional Expectation. Convergence in Probability – Weak Law of large Numbers and strong law of large Number – Central limit Theorem – Discrete distributions: Binomial, Poisson. Continuous Distributions: Normal Distribution Chi-Square, t and F distributions and their properties.

Application of Statistical Methods – Sampling Theory: Introduction to the theory of Sampling: Sampling designs – Simple Random Sampling with and without replacement – Systematic, Stratified, Ratio and Regression Sampling methods – Determination of sample size – Sampling and non – sampling errors – Cluster sampling, Purposive Sampling Quota Sampling. Testing of Hypothesis: Introduction to Testing of Hypothesis: Simple, Null and Alternative hypotheses, composite hypothesis, two kinds of Errors – Degrees of freedom – Critical Region – One-tailed and Two-tailed tests – P-Value – Confidence Intervals –Power function. Testing of significance using chi-square, t and F tests. (simple problems) – Non-Parametric Tests ANOVA – One way and Two way classifications. Application of Statistical Methods through MS-Excel – Language : Over view of MS-Excel: Construction of charts and diagrams – Sorting – Filtering – Removing duplicates – Calculation of Measures of Central tendency, Measures of dispersion, correlation Regression and curve fitting using – Excel. Linear Programming Problem: Graphical Methods – Travelling Salesman Problem – Assignment Problem – Simplex Methods.

## Unit IV: Mathematics (20 Questions)

Algebra: Groups – Sub groups – Permutation groups – Normal subgroups and Quotient groups – Homomorphisms – Automorphisms – Cayley's Theorem.

Rings: Rings – Sub rings – Integral Domain – Field – Homomorphisms – Ideals and Quotient Rings.

Linear Algebra: Vector Spaces – Basic Concepts – Linear Transformations – Linear Independent and Bases – Inner Product Spaces.

ODE: ODE with constant coefficients – ODE with variable coefficients – Higher order ODE's.

PDE: First order PDE – Second order PDE – Elliptic – Parabolic and Hyperbolic PDE's.

Real Analysis: Properties of monotonic functions – Functions of bounded variations – Total variations –

Additive property of total variation – Total variation on  $[a,x]$  as a function of  $x$  – Continuous functions of bounded variations – Infinite Series: Absolute and conditional convergence – Dirichlet's test and Abel's test Rearrangement of series – Riemann's theorem on conditionally convergent series.

Complex Analysis: Differentiability and Cauchy–Riemann Equations – Harmonic Functions – Power Series as an Analytic Function – Complex Integrations – Cauchy Integral Formula – Morera's Theorem – Existence of Harmonic Conjugate – Taylor's Theorem – Conformal mappings.

Functional Analysis: Metric Spaces and continuous functions – Normed Spaces – Convergence, completeness and Baire's Theorem – Bounded Linear Maps on Banach Spaces – Bounded Operators on Hilbert Spaces.

Topological Spaces: Basis for a Topology – The Product Topology – The Metric Topology – Connected Spaces – Connected Subspaces of the Real Line Components – Urysohn's lemma.

Measure Theory: Measure on the Real Line – Measurable Functions – Measure Spaces – Convergence.

### **Unit V: Business Administration (20 Questions)**

Management – Concept and Foundations of Management – Managerial Functions – Decision making and Models – Authority and Responsibilities – Business ethics – Organizational behaviour concept – Leadership and power – Organizational Climate and Culture – Groups Dynamics in organization – HRM – Functions – Job Analysis – Job Evaluation – Recruitment and Selection – Training and Development – Performance appraisal and 360 degree feedback – Promotion and Transfer – Compensation – HR Audit – Organizational Misbehaviour – Current trends and issues in HRM – Quality of work life balance – Conflicts in organization – Fundamentals of operations management – Production Planning – Capacity Planning – Plant Layout and Design – Morden Production concept – JIT, Kaizen, Japanese 5's framework – Quality Management – TQM – Six Sigma – Resources Optimization Modals – PERT – CPM – Linear Programming Modals – Nature and Scope of Financial Management – Finance Function – Sources of Finance – Financing Decision – Risk Management – Cost of Capital and Capital Structure – Investment Decisions – Valuation Concepts and Valuation of Securities – Capital Budgeting – Working Capital Management – Dividend Decisions – Cost functions – Break even analysis – Marketing Management – Scope and Evolution – Marketing Strategy Formulation and Components of Marketing Plans – Segmenting and Targeting the Market – Product Positioning and Differentiating of the Market – Analysing Competition and Consumer Market – Consumer Behaviour – Industrial buyer Behaviour – Marketing Research – Product and Pricing Strategy – Marketing Channels – CRM (Customer Relationship Management) Process – Customer Satisfaction – Rural Marketing – Basics of Business Law and Labour Law – Vision and Mission – Nature and Scope of Strategic Management – Strategic Indent– Process of Strategic Planning and Implementation – SWOC (Strength, Weakness Opportunity and Challenge) Analysis – BCG Matrix – Balanced Score Card – Business Analytics and Visualisation – Block Chain Technologies – ERP and MIS (Enterprise Resource Planning and Management Information System) Supply Chain Concept – Business Intelligence – E–Business and E–Commerce – AI in Management.

### **Unit VI: Sociology and Social Work (20 Questions)**

**Sociology:** Meaning, Nature and Scope of Social Thought. Auguste Comte: Law of Human Progress. Hierarchy of the Sciences. Social Statics and Dynamics, Positivism. Herbert Spencer: Theory of Evolution, Types of Society, Organic Analogy. G. F. Tonnies: Gemeinschaft and Gesellschaft and Public Opinion– Emile Durkheim: Social Facts, Rules of Sociological Methods, Division of Labour, Theory of Suicide, Religion and Society. Structuralism: Claude Levi Strauss – Structural Anthropology – Binary Opposition, Bronislaw Malinowski–Bio–cultural functionalism. Structural–Functionalism: A.R. Radcliffe– Brown – Study of Social Relationship as Integrated Social System–Karl Marx: Historical Materialism, Mode of Production, Surplus Value, Class Struggle, Alienation– Max Weber: Social Action, Ideal Type, Authority, Bureaucracy, Protestant Ethic and the Spirit of capitalism. Vilfredo Pareto: Logical and non–logical Action, Circulation of Elites. George Simmel: Formal Sociology. Social Types. Philosophy of Money. Karl Manheim: Sociology of Knowledge.

Definition of Scientific Research: Science and Its Characteristics. Features, Purpose, and Assumptions of Scientific Method. Steps in Scientific Method. Applicability of Scientific Method to the Study of Social Phenomena. Theory – research relationship (Induction, deduction and abduction). Philosophy of Social sciences: Ontology: Objectivism, Constructivism, Realism, Idealism; Epistemology: Positivism, Interpretivism, Critical Epistemologies, Standpoint Theory; Axiology: Values In Research, Ethics, Reflexivity, Positionality –Paradigms: Positive, Interpretive, Critical, Feminist, Postcolonial, Queer–Ethics in Social Research – informed consent, confidentiality, anonymity, digital research ethics– Quantitative

Methods and Survey Research –Nature, Scope and limitations of quantitative research methods– Qualitative Research – Case study – Ethnography – Phenomenology – Ethnomethodology – Grounded. Mixed Method Research Design – Types – Triangulation Method. Sociometry, Survey techniques, participant observation – In – depth interviews, life histories, oral narratives –Focus group discussions – Field notes, thick description, reflexive journals – Measurement and Scaling Techniques: Need for Scales, Problems of Scaling, Methods of Scale Construction –Content analysis, Thematic analysis, Narrative analysis, Interpretative Phenomenological Analysis (IPA), Descriptive Phenomenological Analysis (DPA) Discourse analysis–Mixed Method–data analysis – Secondary Data Analysis – Strategies for data integration –Introduction to data analysis software – SPSS, Nvivo, ATLAS.ti

**Social Work:** Concept, objectives, Definition, Principles –methods, values and Historical development of Social Work in UK, USA and India. Professional Social Work vs Voluntary Social Work. Social Work Practice in Community, Industry, Hospital, School, correctional institution and rehabilitation institutes. Social Work administration: Meaning, purpose, functions. Social Welfare administration in National, State and local level. Social Agency: Types and Models of NGOs. Social Policy: Need, Evolution, Constitutional base. Policy and programme for Women, Children, Youth, Aged, Handicapped , SC, ST and OBC. Fundamental Rights, Directive principles of State policy. NITI Aayog. PRA and PLA. Project Evaluation: Identification and Formulation. Project appraisal methods, Project Evaluation tools. Community Impact assessment, Vulnerability Assessment and SDGs Assessment.

### **Unit VII: Anthropology (20 Questions)**

Anthropology: Introduction–Origin and History; Meaning, Definitions and Uniqueness; Scope–Utility and Branches; Relationship with other disciplines–Archaeology, History, Sociology, Psychology, Economics and Politics; Foundations of Society and Culture–Definitions, Elements and Characteristics, Social Institutions and Organizations– Marriage, Family, Descent and Kinship; Rite–de–Passages, Magic and Religious organization, Economic and Political organization; Emergence and Dispersal of Homo sapiens– Out of Africa Theory; Stages of Human Evolution; Peopling and People of India; Practicing Anthropology– Applied, Advocacy and Public Anthropology.

Indian Culture and Civilization: Palaeolithic, Neolithic, Megalithic and Indus Valley Harrappan and Lothal cultures; Demographic profile of India–Ethnic and Linguistic elements in the Indian population and their distribution; Concept of Tribe, Scheduled Tribes–Tribal cultures of India, Brief Ethnographic details of Tribes of Tamil Nadu, Problems of the tribal communities, Tribal Development and Administration; Community, Caste, Scheduled Caste and Minorities–Caste–system in India: Structure and characteristics, theories of origin of caste, Dominant caste. Indian village: Social stratification and Indian village as a social system, Peasant cultures – Folk–Urban Continuum; Cultural change in Indian Society: Sanskritization, Westernization, Modernization; Egalitarianism, Cultural relativism, Multiculturalism, Enculturation, Acculturation; Post Modernism and Globalization; Constitutional safe guards for STs/SCs, Role of Anthropology in Tribal, Rural and Urban development. Status of Women and Gender issues in India and Tamil Nadu.

Anthropological Research Methodology–Qualitative, Quantitative and Mixed Methodology–Empirical and Scientific Research; Research Methodology, Method and Techniques, methods, methodology; Fieldwork and Ethnography; Tools of data collection–Participant observation, Interview, Schedules, Case study, Genealogy, Transect–walk, Social mapping, etc.

### **Unit VIII: Agricultural, Resource and Environmental Economics (20 Questions)**

#### **Economic Theory**

Microeconomics – Consumer Behaviour and Markets: Theory of Consumer Behaviour: Utility theory (cardinal/ordinal), Gossen's first and second laws– utility measurement, indifference curve analysis, Consumer Surplus. Demand and Supply: Demand and supply functions, factors affecting demand and supply, elasticity of demand and supply (price, income, cross–price elasticity). Market Structures: Types of Market Structures: Perfect Competition, Monopoly, Monopolistic Competition, and Oligopoly (including modern topics like game theory basics in oligopoly). Price Determination: Price determination under different market structures. Macroeconomics – National Income Concepts and measurement – circular flow of income.

Agricultural Marketing, Prices and international trade: Producer surplus– Marketable and Marketed surplus, Price spread– marketing cost and marketing margin, Marketing Efficiency. Market integration, Marketing Intelligence. Institutions and Policies : Institutions: APMC Act and recent reforms, e–NAM, Regulated Markets, Cooperatives, Commodity Boards, warehouses– SWCs and CWCs, Contract

Farming, Farmers' Markets (Uzhavar Santhais), Farmers Producers Organizations (FPOs). Price Policies: Commission on Agricultural Costs and Prices (CACP), Agricultural Prices– Minimum Support Price, State Administered Prices, Procurement Price, and price support programs/policies. PDS, TPDS, buffer stock operations. Trade Theory: Theory of absolute and comparative advantage. Trade Policy: Terms of Trade and Instruments of Trade Policy; Tariffs and Non–tariff barriers, Balance of Trade vs. Balance of Payments.

### **Rural Finance**

Rural Indebtedness. Sources of finance– Financial institutions– Cooperatives, Commercial Banks, and Regional Rural Banks (RRBs), Priority Sector Lending: Differential Rate of Interest Scheme. Lead Bank Scheme, Higher financial institutions– NABARD and RBI, District Credit Plan. Financial Management– Discounted and undiscounted measures – Financial statements and ratio analysis. Partial and complete budgeting Micro–Financing: Role of MFIs, NGOs, and Self–Help Groups (SHGs). Financial Inclusion. Relief measure of rural indebtedness – Nationalisation of banks. Risk and Insurance: Risk in agriculture and different Crop Insurance Schemes

Production Economics: Types and forms of production functions. Returns to scale vs. Economies of scale. Classical production function, production relationships, Cost Concepts: Fixed Cost (TFC), Variable Cost (TVC), Total Cost (TC), Average Cost (AFC, AVC, ATC), and Marginal Cost (MC). Cost of cultivation vs. Cost of Production. Efficiency Measures: Technical Efficiency, Economic Efficiency, and Allocative Efficiency.

### **Natural Resource Economics**

Concepts and Classification: Concepts, classification (exhaustible, renewable, recyclable), and problems of Natural Resource Economics. Economy–Environment Interaction: Fundamental interactions and the concept of a circular economy. Resource Scarcity: Resource scarcity definitions (absolute, relative), Limits to Growth debate, measuring and mitigating natural resource scarcity, scarcity indices, and Malthusian vs. Ricardian Scarcity. Optimal Resource Management: Theory of optimal extraction of exhaustible (Hotelling's rule) and renewable resources (e.g., fisheries models, forestry models). Property Rights and Management: Issues in natural resource management; private property, common property, and open access resources (Tragedy of the Commons). Collective action in common property resource management (Elinor Ostrom's principles). Spatial Planning: Land use planning; optimal management of land, water, forests, and fisheries. Technology: Resource mapping; modern applications of GIS (Geographic Information Systems) and Remote Sensing in resource management.

### **Environmental Economics**

Environmental Problems and Quality: Economics of the environment; Externalities– theory of externality (Pigouvian taxes/subsidies, Coase theorem). Pollution: Sources and types of pollution (air, water, solid waste, land degradation); environmental and economic impacts. Pollution Control: Economics of pollution control; efficient reduction in environmental pollution (Marginal Abatement Cost). Regulation: Environmental regulation; economic instruments (e.g., cap–and–trade, pollution taxes, subsidies) and indirect instruments (command and control policies, performance standards). Legislation: Environmental legislations in India.

### **Unit IX: Public Administration (20 Questions)**

Public Administration: Definition, Meaning, Scope and Significance – Public Administration Principles and Practices – Evolution of Present Status of the Discipline – Dichotomy – Public vs Private Administration – Approaches to the Study of Public Administration: Kautilya, Tiruvalluvar, F.W.Taylor, Luthur Gulick and Urwick – Comparative Public Administration – Development Administration – New Public Administration – New Public Management – Personnel Administration – Principles of Organization and Administration – Classical theories – Human Relation theories – Modern theories of Administration – Administrative Responsibility and Ethics .

Public Financial Administration: Budgetary process and accountability – Types of Budget – Resource Mobilization, Tax Administrations and Financial Control – Union – State financial relations in India – Good Governance: Social welfare schemes in Tamil Nadu, Women Empowerment schemes in Tamil Nadu, Health care Policy in Tamil Nadu – E. Governance : ICT application in government – IT parks in Tamil Nadu – District administration: e–governance in Districts, THAI scheme, Pudhuvazhvu Scheme – Special Economic Zones – Panchayat Raj: Rural Development Programmes in Tamil Nadu, Environmental Protection in Tamil Nadu – Administrative Reforms in India – Urban Governance: Urban Local Bodies in

### **Unit X: Research Methodology (20 Questions)**

Research Methods: Research Problems – Formulation, Conditions and Considerations – Meaning, Categories, and Operationalization – Variables: Meaning, Types, and Measurement – Review of literature: Scope and Purpose of literature review, Processes and sources of reviewing the literature – Types of reviews – narrative, systematic, scoping, meta – analysis, critical, meta – synthesis – Quantitative Methods and Survey Research – Nature, Scope and limitations of quantitative research methods – Qualitative Research Design: Need for Research Design, Features. Types: Exploratory, Descriptive, Explanatory, Experimental, Evaluative, and Action – Sources of Data: Primary and Secondary Data – Sampling: Introduction to the theory of sampling; Probability and non-probability methods – sampling and non-sampling errors – Hypothesis: Functions, Conditions for a Valid Hypothesis, Formulation of Hypothesis, Forms of Hypothesis, Hypothesis Testing: Simple, Null and alternative hypotheses, composite hypothesis – Tools of quantitative data collection – structured, unstructured – open ended and closed ended questions – Qualitative data collection – interview guide – questionnaire – Rule of translation of interview schedule and questionnaire – rule of translation and back translation – Pilot study – Methods of Data Collection: Interview – Secondary Data collection – Observation Methods: Direct Personal Observation (participant and non-participant observation). Mechanical/Electronic Devices (e.g., cameras, sensors, GPS) – Other Contemporary Methods: Case Studies, Experiments, Projective Techniques, and Delphi – Reliability and validity of data – limitations of data collection method (errors in data collection) Technique Data analysis – Organizing, Analysing, and Summarizing quantitative data, Editing – Coding, Classification, Tabulation, Interpretation – Report writing – Format, Footnotes, Figures, – Reference Material: References/Bibliography: A comprehensive list of all sources cited, following a consistent citation style (e.g., APA, MLA). Appendices: Supplementary materials like raw data, sample questionnaires, detailed maps, or complex tables. Evaluation Criteria for a Good Report: Objectivity and lack of bias. Logical structure and clear, formal language. Reliability and validity of data and findings. Proper documentation and ethical considerations (e.g., informed consent, confidentiality).

## **18. Financial and Cost Accountancy (Intermediate Standard)**

**Code: 433**

### **Unit I: Accounting (10 Questions)**

- a) Accounting Standards (old) 2, 10, 12 and 16
- b) Accounting for Cooperative Societies
- c) Branch and Departmental Accounts (including foreign branches)
- d) Accounting for non-profit organizations and incomplete records
- e) Computerized Accounting System

### **Unit II: Auditing (20 Questions)**

- a) Nature and scope and significance of auditing
- b) Audit Engagement, Audit Programme, Audit working papers, Audit note book audit evidence and audit report
- c) Internal check, internal control and internal audit – industry specific
- d) Auditing of difference types of undertaking – education, hospitals, cooperative societies, trusts, municipalities

### **Unit III: Financial Management (30 Questions)**

- a) Meaning – objectives – scope of financial management
- b) Tools for Financial Analysis – Ratio, Cash flow analysis
- c) Analysis and Interpretation of Financial Statements
- d) Investment decisions – ARR, Pay back, NPV, IRR, PI
- e) Cost of Capital Structure and Leverages
- f) Working Capital Management – Financing – Cash, Inventory, Receivables and Payables

**Unit IV: Direct Taxation (10 Questions)**

- a) Heads of Income and Computation of Total Income under various heads
- b) TDS/TCS/Advance Tax
- c) Taxation as applicable to Government undertaking and Cooperative Societies.

**Unit V: Indirect Taxation (30 Questions)**

- a) Canons of Taxation
- b) Goods and Services Tax(GST)
  - 1. CGST-SGST-IGST- Cess
  - 2. Registration – Supply – Time of Supply – Value of Supply – Place of Supply – Input tax credit – Reverse Charge Mechanism (RCM) – Payment of Taxes.
- c) Filing of GST periodic returns

**Unit VI: Commercial Law, Industrial Law & Company Law (20 Questions)**

- a) Indian Contract Act
- b) Sale of Goods Act
- c) Negotiable Instrument Act
- d) Factories Act, Payment of Gratuity Act
- e) Employees Provident Fund Act 1952
- f) Employees State Insurance Act 1948
- g) Payment of Bonus Act 1965, Minimum Wages Act 1948
- h) Tamil Nadu Tender Transparency Act, 1998

**Unit VII: Cost Accounting: Prime Cost and Overheads (20 Questions)**

- a) Material Cost
  - a. Purchase procedures, ledgers and forms (MRN, GRN etc.)
  - b. Inventory levels management
  - c. Stores ledger under FIFO, Weighted average, retail price
  - d. Physical stock taking and inventory reconciliation
  - e. Wastage and shortage
- b) Labour
  - a. Remuneration methods
  - b. Measuring production and productivity
  - c. Incentive Schemes: Halsey, Rowan, Taylor
  - d. Labour Turnover
- c) Overhead
  - a. Cost grouping, allocation and apportionment
  - b. Treatment of under and over absorption
  - c. Machine hour rate computation

**Unit VIII: Cost Accounting: Book Keeping and Methods (15 Questions)**

- a) Costing accounting records, Ledgers, Cost statements
- b) Items excluded from cost and normal and abnormal, terms/cost
- c) Integral accounts
- d) Reconciliation of cost accounting records with financial accounts
- e) Process, job, contract, and Batch costing
- f) Service costing: hospital, transport, hotel etc.

**Unit IX: Cost Accounting: Techniques (15 Questions)**

- a) Marginal costing
  - a. CVP analysis
  - b. Break even point and Margin of safety
  - c. Break even chart
  - d. Cost indifference point
  - e. Key factor analysis

- b) Standard costing and variance analysis
  - a. Material
  - b. Labour
  - c. Variable Overheads
  - d. Fixed Overheads
  - e. Sales variances
  - f. Sales margin variances

**Unit X: Budget and Budgetary Control (30 Questions)**

- a) Concepts, Types of Budgets
- b) Budgetary Control Vs Standard Costing
- c) Advantages and Limitations
- d) Preparation of Various Budgets
- e) Zero Base Budgeting

**19. Geology  
(PG Degree Standard)**

**Code: 395**

**Unit I: General Geology and Geomorphology (20 Questions)**

Origin, Evolution, Age and Interior of the Earth - Principles of geodesy – Rock cycle – Isostasy - Continental drift, Seafloor spreading, Plate tectonics - Paleomagnetism and its application for determining paleoposition of continents – Orogeny and Epeirogeny – Volcanoes and earthquakes – Effects and causes – Seismic Hazard zonation of India - Tectonic deformation and seismicity in the Extra Peninsular, Indogangetic plains and Peninsular India - Applications of geomorphology in mineral prospecting and coastal studies - Weathering – processes and products - Geomorphic cycles and their interpretation - Morphology and its relation to structures and lithology - geomorphic landforms formed by action of rivers, wind, glaciers, waves and groundwater - Features of ocean floor - continental shelf, slope and rise - concepts of landscape evolution, major geomorphic features of India – coastal, peninsular and extra peninsular - Classification of shorelines and their evolution - submarine canyons, Geosynclines and Island arcs.

**Unit II: Stratigraphy (20 Questions)**

Principles of stratigraphy - Code of stratigraphic nomenclature of India - lithostratigraphy – biostratigraphy – chronostratigraphy – magnetostratigraphy, sequence stratigraphy - Principles of stratigraphic correlation; Indian stratigraphy and economic importance - Cratons of India – Dharwar, Bastar, Singhbhum, Aravalli and Bundelkhand Cratons - Proterozoic mobile belts – Eastern Ghats Mobile Belt, Southern Granulite Terrain, Central Indian Tectonic Zone, Aravalli – Delhi Belt, North Singhbhum Mobile Belt - Proterozoic sedimentary basins – Cuddapah, Delhi, Vindhyan, Kurnool and Kaladgi - Phanerozoic stratigraphy – Paleozoic - Spiti, Kashmir and Kumaon - Mesozoic - Spiti, Kutch, Narmada Valley and Tiruchirapalli erstwhile Trichinopoly - Gondwana Supergroup, Deccan Traps - Cenozoic Assam, Bengal basins, Garhwal-Shimla Himalayas – Siwaliks - boundary problems in Indian stratigraphy Precambrian-Cambrian boundary - Permian-Triassic boundary - Cretaceous-Paleogene (K-Pg) formerly Cretaceous-Tertiary (K-T) boundary - Paleogene-Neogene and Neogene-Quaternary boundary.

**Unit III: Paleontology (20 Questions)**

Fossil record and geological time scale - modes of preservation of fossils and concept of taphonomy – Body and ichno-fossils, species concept, organic evolution, Ediacara Fauna - morphology and time range of Graptolites, Trilobites, Brachiopods, Lamellibranchs, Gastropods, Cephalopods, Echinoids and Corals - Evolutionary trends in Trilobites, Gastropods, Cephalopods; and Graptolites - Micropaleontology – methods of preparation of microfossils, morphology of microfossil groups (Foraminifera, Ostracoda), Fossil spores and pollen - Application of micropaleontology in oil exploration - Gondwana plant fossils and their age and climate significance - Vertebrate life through ages, evolution in Proboscidea, Equidae and Hominidae - Dinosaurs – their classification and extinction - Applications of paleontological data in stratigraphy, paleoecology, and paleoclimatology - Mass Extinctions.

#### **Unit IV: Structural Geology (10 Questions)**

Mechanical principles of rocks – Strain markers in deformed rocks - Mohr's circle – V rules and outcrop patterns – Stereographic Projections of structural elements - Mechanics and causes of folding and faulting - Classification of folds and faults - Recognition of folds and faults in the field - Joints – Cleavage and Schistosity types and origin – Secondary lineation - Types of unconformity and their recognition in the field – Introduction to Petrofabric analysis – Tectonites, their classification and geological significance.

#### **Unit V: Mineralogy and Crystallography (25 Questions)**

Definition, Classification and elements of minerals and Crystallography – Optical, Electrical and Magnetic Properties of minerals - Physical, chemical and optical properties of Quartz, Feldspars, Feldspathoids, Pyroxene, Amphibole, Olivine, Garnet, Mica, Zeolites and Carbonate groups - Stereographic and Gnomonic projections of natural crystals of normal classes. 14 Bravais lattices and their derivation - Derivation of 32 classes of symmetry - Elements of X-ray crystallography - Napier's theorem - Equations of a normal - Bragg's law - X-ray diffraction method - Identification of minerals from X-ray diffractogram – Concept of optical mineralogy – Identification of minerals using petrological microscope.

#### **Unit VI: Igneous and Metamorphic Petrology (25 Questions)**

Classification of Igneous rocks: Mineralogical, Chemical and IUGS classification – Structures and textures - Petrography and petrogenesis of Granites, Alkaline rocks, Anorthosites, Carbonatites, Dolerites, Ultramafics - Study of binary and ternary system of crystallisation - Bowen's reaction series - Diversity of Igneous rocks – variation diagrams - Crystallisation of Basaltic magma - Metamorphism – Agents and kinds of metamorphism – classification of metamorphic Rocks – Textures and Structures – Different grades and depth Zones – Metamorphic facies – Metamorphic differentiation – Thermal – Clastic and Regional Metamorphism – Origin of Eclogites – Charnockitisation – Granitisation – Metasomatism.

#### **Unit VII: Sedimentology (20 Questions)**

Sedimentary depositional environments – Important clastic and non-clastic rocks – Heavy minerals and Provenance – Tectonics and Sedimentation – Sedimentary Basins of India – Paleocurrents and Basin Analysis - Classification of sedimentary rocks - sedimentary textures grains size, roundness, sphericity, shape and fabric - grain size analysis - sediment transport and deposition - sedimentary structures Penecontemporaneous deformation structure and biogenic structures - principles and application of paleocurrent analysis - composition and significance of different types of sedimentary rocks Sandstone, Limestone, Banded Iron Formation, Mudstone and Conglomerate - carbonate diagenesis and dolomitisation - sedimentary environments and facies-facies models - fluvial, glacial, deltaic, siliciclastic shallow and deep marine environments - carbonate platforms – types and facies models; sedimentation in major tectonic settings; Application of sequence stratigraphy in basin analysis.

#### **Unit VIII: Economic Geology (25 Questions)**

Classification of mineral deposits – Process of formation of mineral deposits - Magmatic, Hydrothermal, Sedimentary, Metamorphic, Sublimation, Evaporation, Oxidation and Supergene enrichment - Metallogenic Epochs and provinces of India - Introduction of ore microscopy – Physical and optical properties of ore minerals – Textures and microstructures of ores – Controls of ore Localisation – Fluid inclusion in ore mineral assemblages – Origin, Occurrences, Indian distribution and uses of the following ores - Iron, Manganese, Copper, Lead, Zinc, Aluminium, Chromium, Gold, Barite, Graphite, Asbestos and Silica, Uranium, Thorium and Industrial Minerals. Origin of coal and petroleum - Physical and Chemical Properties of coal and petroleum – Deposits of coal and Petroleum in India – Distribution of Gondwana and Tertiary coal fields of India. Gas hydrates and Coal bed methane, Petroliferous basins of India – Lignite deposits in India – Strategic, Critical and essential minerals – National mineral policy 2019 – Conservation and Utilization of mineral resources.

#### **Unit IX: Hydrogeology (15 Questions)**

Occurrence of groundwater - Aquifers - Major Basins and Drainage systems of Tamil Nadu - Groundwater flow - Darcy's Law - Hydraulic conductivity and Hydrological parameters - Transmissibility, Permeability - Specific yield and retention - Hydrogeological characters of different types of rocks - Rock water interaction - Types of wells - Drilling methods and methods of construction, Design and development and Well logging methods - Pumping test methods - Estimates of groundwater potential and recharge - Managed Aquifer

recharge – Rainwater Harvesting techniques and methods - Aquifer recharge methods - Seawater intrusion - Study and methods - Electrical methods of groundwater exploration - Tracer – Isotope techniques.

### **Unit X: Applied Geology (20 Questions)**

Geophysical methods of prospecting – Electrical, Magnetic, Gravity and Seismic – Radioactive methods – Geochemical classification of elements and anomaly – Geochemical cycle – Geochemical prospecting – Engineering properties of Rocks – Geological investigations pertaining to Dams, Reservoirs, Tunnels, Bridges and Roads – Rock sampling techniques – Ore reserve estimation and UNFC. Mining Methods: Surface and Sub surface – Coal and Alluvial – Prominent mines and mineral legislations of India – Environmental impacts (EIA) due to mining and mineral processing – Role of Geologist in mining industries. Natural Hazards - Floods, Landslides, Earthquakes and Tsunami – Causes and Mitigation. Renewable and non renewable resources. Applications of Remote sensing - GIS and GPS in Geological studies.

## **20. Horticulture (UG Degree Standard)**

**Code: 493**

### **Unit I: Fundamentals of Horticulture (15 Questions)**

Scope and importance – State, National and Global scenario of horticultural crops – Area and production – Import and export – Nutritive value and Medicinal value of horticultural crops – Horticultural zones of Tamil Nadu and India – National and regional agencies involved in promotion of horticultural industry in India (NHB, APEDA, Commodity Boards and Government schemes) – Classification of horticultural crops – Factors limiting horticultural crop production – Role of season – Soil and climate requirements - Physical and chemical properties of soil - Climatic factors – Light, temperature, photoperiod, relative humidity, rainfall, altitude, microclimate - Kitchen gardening - Nutrition gardening – Truck gardening – Market gardening - Vegetable forcing - Protected and precision horticulture – Hydroponics, Aeroponics – Nutrient Film Technique – Vertical farming - Horticulture therapy.

### **Unit II: Growth and Development of Horticultural Crops (15 Questions)**

Important phases of growth and development - Bearing habits – Classification of horticultural crops based on life cycle – Annual, biennial perennial (woody and herbaceous perennials) – Fruitfulness and unfruitfulness - External and internal factors associated with unfruitfulness – Physiology of flowering, fruit set, ripening and senescence – Fruitdrop - Causes and control measures - Plant growth regulators – Functions and role in horticultural crops - Bud dormancy – Dormancy breaking – Parthenocarpy – Parthenogenesis – Polyembryony – Stenospermocarpy – Vivipary - Apomixis.

### **Unit III: Propagation of Horticultural Crops (15 Questions)**

Propagation – Definition – Establishment of nursery – Site selection - Tools and implements propagation structures - Mist chamber, phytotron - Humidifiers – Greenhouse – Glasshouse – Polyhouse - Shade net, glass house, poly tunnels, cold frames and hotbeds, pit nursery - Media and containers – Soil sterilization - Sexual propagation – Merits and demerits – Crops propagated through seeds - Seed viability, longevity, dormancy, germination – Pre-sowing treatment – stratification, scarification, seed priming, seed pelleting, seed invigoration, seedling vigour – Raised seed bed and pro-tray nursery – Asexual propagation – Merits and demerits – Methods of vegetative propagation – Identification of plus trees – Mother block, scion bank – Clonal nursery – Chimeras - Cutting – Layering – Grafting, budding types – Anatomical and physiological basis of grafting – Stock scion relationship, graft compatibility Budwood selection and certification – Top working and after care - Propagation through specialized plant parts (bulbs, tubers, offsets, runners, suckers, slip, crown, rhizomes, corms) – Quality management and nursery certification – Micro propagation – Application – infrastructure requirements – Types of media – Stages of micro propagation – Micro grafting – *in vitro* propagation of important horticultural crops.

### **Unit IV: Management Techniques for Horticultural Crops (15 Questions)**

Planning – Layout and management of orchards – Fencing – Wind breaks and shelter beds – Spacing – Planting system – Physical and chemical properties – Soil reaction – acid, saline and alkaline soils – Soil fertility - Essential elements – Functions - Organic manures and inorganic fertilizers, Water soluble

fertilizers - Bio-fertilizers, vermicomposting - Applications and management – Nutrient deficiencies and corrective measures - Physiological disorders and remedies – Irrigation, micro irrigation and maintenance – Critical stages of water requirement – Effect of water stress on crop yield – Anti-transpirants – management of irrigation water quality - Conventional and micro irrigation – Fertigation - Mulching – Sod culture – Weed management – Application growth regulators – Training and pruning principles and methods - Rejuvenation of senile and old orchards – Cropping systems - Cover cropping - Multitier cropping – Intercropping – Special horticultural techniques (pinching, thinning, disbudding, blanching, smudging, notching, ringing) - Principles of organic horticulture – GAP and GMP.

#### **Unit V: Production Technology of Fruit Crops (30 Questions)**

Scope and importance of fruit crops - Composition and uses - Origin and distribution – Species – Season - Climate and soil requirement – Varieties and hybrids – Propagation techniques - Planting systems and planting density including High density planting (HDP) and ultra high-density planting (UHDP) – spacing – Water and nutrient management – Fertigation - Weed management - Canopy management - Training and pruning – Intercultural practices - Off season production - Special horticultural techniques – Use of plant growth regulators – Maturity indices - Harvest and yield – Nutrient deficiencies and physiological disorders and its corrective measures and management of important pest and diseases of important fruit crops :- Mango, Banana, Acidlime, Sweet orange, Mandarin, Grapes, Papaya, Guava, Sapota, Pineapple, Jackfruit, Pomegranate, Aonla, Annona, Ber, Sweet tamarind, Jamun, Fig, Apple, Pear, Plum, Peach, Strawberry, Litchi, Avocado, Carrisa, West Indian Cherry, Date Palm, Phalsa, Bael, Wood apple, Rose apple, Bread fruit, Bilimbi, Durian, Carambola, Mangosteen, Loquat, Passion fruit, Rambutan, Pumelo, Grape fruit, Cherries, Currants, Apriocot, Perssimon, Olive, Pecanut, Chestnut, Hazelnut, Kiwi, Pistachionut, macadamianut, Walnut and Almond and minor tropical, arid and temperate fruit crops.

#### **Unit VI: Production Technology of Vegetable Crops (30 Questions)**

Scope and importance of vegetable crops - Composition and uses - Origin and distribution – Area and production - Soil and climatic requirements - Varieties and hybrids – Propagation methods - Seed rate – Sowing and nursery practises – Containerized seedling production - Season – Planting methods – Water, nutrient and weed management – Fertigation – Training for vegetables – Intercultural practices - Maturity indices – Harvest and yield – Nutrient deficiencies and physiological disorder and its corrective measures of important vegetable crops: Tomato, Brinjal, Chilli and Capsicum (Sweet Pepper), Bhendi, Leguminous vegetables (Beans, Peas, Cluster beans, Cowpea, Dolichos bean); Bulbous vegetables (Onion, Garlic); Tuber crops - (Potato, Tapioca, Sweet potato, Elephant foot yam, Dioscorea, Chinese potato, Colacassia); Cucurbitaceous vegetables (Cucumber, Bitter gourd, Snake gourd, Ridge gourd, Ash gourd, Musk melon, Water melon, Pumpkin) - Cruciferous vegetables (Cabbage, Cauliflower, Knol khol, Brussels sprout, Sprouting broccoli and Chinese Cabbage); Root vegetables (Carrot, Radish, Beetroot, Turnip) - Leafy vegetables (Spinach, Lettuce, Palak, Amaranthus, Agathi and Asparagus) – Perennial vegetables (Drumstick, Coccinea) – Protected cultivation of vegetable crops - Precision farming of important vegetable crops and seed production.

#### **Unit VII: Floriculture & Landscape Gardening (30 Questions)**

Scope and importance of flower crops production - Uses - Origin and distribution – Area and production - Climate and soil requirement - Species and varieties - Propagation, season - Spacing and planting methods - Irrigation, nutrient management – Fertigation – Weed management - Training and pruning – Intercultural operations – Special horticultural techniques – Growth regulators – Off season production - Maturity indices – Harvest and yield and management of important pest and diseases for important loose flower crops: Jasmine, Rose, Tuberose, Chrysanthemum, Marigold, Nerium, Ixora and Crossandra - Cut flowers - Rose, Carnation, Anthurium, Orchid, Liliium and Gerbera – Cutfoliage and fillers. Principles of Landscape designing – Styles of gardening - Types of gardening viz., Hindu, English, Mughal, Japanese, Persian, Italian, French gardening Garden components – Trees foliage flowering and avenue trees – Burlapping – Shrubs -Hedge and edge plants – Flowering annuals creepers and Climbers - Cacti and succulents Lawn – Types of grasses – Layout, planting and maintenance of lawn –Indoor plants and interior scaping – Garden adornments - Principles and styles of flower arrangements – Bonsai styles and culture – Industrial, Institutional, Public and Private landscaping - Special types of gardening –Kokedama, tray, terrarium, roof and vertical gardening – Computer Aided Designs for Landscaping – AUTOCAD garden design.

### **Unit VIII: Production Technology of Spices and Plantation Crops (20 Questions)**

Scope and Importance of spices and plantation crops - Composition and uses - Origin and distribution – Area and production – Climate and soil requirements - Species and varieties - Season, seed rate / Vegetative propagation methods – Spacing - Planting systems – High density planting (HDP) – Ultra High Density Planting (UHDP) - Irrigation and nutrient management – Fertigation - Weed management – Training and pruning – Cropping systems – Multitier cropping – Cover cropping – Inter cropping - Growth regulators – Mulching - Shade trees and canopy regulation – Maturity indices, harvest, yield and management of important pests and diseases - Processing methods of important plantation and spice crops: Major spices, seed spices, tree spices, herbal spices and minor spices - Black Pepper, Cardamom, Turmeric, Ginger, Curry leaf, Clove, Nutmeg, Cinnamon, Coriander, Fenugreek, Cumin, Tamarind, Allspice and Vanilla – Plantation crops - Tea, Coffee, Rubber, Cocoa, Coconut, Oilpalm, Cashew, Palmyrah and Arecanut.

### **Unit IX: Production Technology of Medicinal and Aromatic Crops (10 Questions)**

Scope and importance of medicinal and aromatic crops - Composition and uses - Origin and distribution – Area and Production - *Ex situ* and *in situ* conservation – Classification of medicinal and aromatic crops – Constraints in medicinal plants cultivation - Climate and soil – Varieties – Propagation - Nursery practices - Planting methods - Cropping systems – Manures and Fertilizers – Irrigation – Intercultural operations – Harvest indices – Harvest and yield - Management of important pests and diseases - Production systems - Contract farming – Good Agricultural Practices (GAP) – Good Cultivation Practices (GCP) – Good Manufacturing Practices (GMP) - Organic production and certification – Classification and distillation methods of essential oils – Secondary metabolite production - Value addition - Organisational support for promotion of medicinal and aromatic crops - Medicinal crops: Senna, Periwinkle, Glory lily, Aswagandha, Medicinal coleus and Solanum, Sweet flag, Aloe, Isabgol, *Phyllanthus*, *Stevia*, Opium poppy. Aromatic crops: Lemon grass, Citronella, Vetiver, Ocimum, Davana, Mint, Geranium, Patchouli and Eucalyptus.

### **Unit X: Post-Harvest Technology of Horticultural Crops (20 Questions)**

Importance of Post-harvest handling in horticultural crops – Maturity indices – Postharvest handling methods – Ripening chambers – Washing – Grading - Waxing – Grades and standards – Methods of packing - Types of containers and their advantages and disadvantages – Storage - Principles and methods of refrigerated storage - Storage methods - Pre-cooling - Controlled Atmospheric Storage (CAS), Modified Atmospheric Storage (MAS) – Low pressure storage and cold chain concept - Importance and scope of processing industries in India - General principles of fruit and vegetable preservation like canning, dehydration, freezing, fermentation - Use of chemicals (preservatives) and irradiation – Good Manufacturing Practices (GMP) – Food safety and quality control.

## **21. Industrial Safety and Health (Degree Standard)**

**Code: 515**

### **Unit I: Chemical Technology, Chemical Process Calculations, Thermodynamics, Fluid Mechanics and Mechanical Operations (20 questions)**

Fertilizers, Cement, Glass, Ceramic and Refractories, Oils, Soaps and Detergents, Pulp and paper, Dyes, sugar, leather and rubber, polymer, pharmaceutical and food industries.

Properties of gases, liquids and solids, Humidity and saturation, Gas laws, Material balance involving recycle, by-pass and purge systems with and without chemical reactions and Energy balances. Material and Energy balance with reactions, Gibbs Phase rule.

Thermodynamics and its applications, thermodynamic functions, compressibility factors, entropy, Chemical Reaction Equilibrium.

Fluid Statics, Newtonian and Non-Newtonian fluids, Equation of continuity, Navier Stroke equation, Friction Factor, Dimensional analysis, Flow through pipes, flow through fixed and fluidized beds, flow meters.

Laws of size Reduction, Mixing and agitation, Filtration, Sedimentation and Conveying of solids. Materials of construction for chemical Industries - Polymeric and composite materials, Nano and biomaterials. Corrosion - prevention and control.

## **Unit II: Heat Transfer, Mass Transfer, Chemical Reaction Engineering and Process Design, Instrumentation and Control (20 questions)**

Modes of Heat transfer, Heat transfer with phase change, heat transfer coefficient. Design of heat exchangers - Double pipe, Shell and Tube. Evaporators - Single and Multiple effect.

Fick's Laws, Diffusion, Mass Transfer Coefficient and theories of Mass Transfer, Momentum, Heat and Mass transfer analogies, Inter phase Mass transfer operations, HTU, NTU and HETP concepts, Design of equipment - Distillation, Extraction, Absorption, Drying. Crystallization and Membrane separation processes.

Reaction rates - homogeneous and heterogeneous reactions, single and multiple reactions in ideal reactors. Residence time distribution. Design of reactors - Isothermal and non-isothermal fixed bed reactors and fluidized bed reactors. Kinetics of heterogeneous catalytic reactions. Diffusion effects in catalysis- rate and performance equations, Catalyst deactivation.

Numerical solutions of linear and non-linear algebraic equations, solution of initial and boundary values, Integration of Simpson rule. Solution of partial differential equations. Eigen value problems - Theorem for Eigen values and Eigen functions.

Sensitivity analysis, Constrained and unconstrained NLP, Newton's method, Quasi-Newton's method, Cost estimation, Plant utilities, pinch technology, Laplace transformation, application to solve ODEs. Open-loop systems, first order systems, first order systems in series, second order systems and their dynamics; transportation lag. Closed loop control systems, feed-back control systems, BODE diagram, stability criterion, frequency response.

## **Unit III: Environmental Engineering, Occupational Safety and Health in Chemical Industry, Mechanics of Machinery and Management in Textile Industry (20 questions)**

Air, Water, Soil pollution and Noise control. Wastewater treatment by various methods: Chemical, biochemical and advanced oxidation process. Industrial hygiene, occupational safety & health in chemical industries, Industrial safety principles, plant layout, chemical hazards identification and classification, Safety in operations and processes, fire safety, hazard identification techniques, disposal of hazardous and toxic wastes, onsite and offsite emergency preparedness plan, safety audit, work permit system, roles and responsibilities of safety officers and welfare officers, occupational diseases.

Kohlberg's theory – Gilligan's theory - Safety and Risk – Assessment, Risk Benefit Analysis and Reducing Risk, Respect for Authority, Collective Bargaining, Confidentiality, Conflicts of Interest, Occupational Crime, Professional Rights, Employee Rights. Intellectual Property Rights (IPR).

Drive transmission, clutches and brakes in textile machinery, design of machine elements – cams, cone drums, drafting rollers; calculations – sley eccentricity, beat-up force; application of industrial engineering in garment industry; costing of yarn, fabric and garment; maintenance of light, temperature and humidity, and ergonomic aspects in textile industry, interpretation of financial statements; investment appraisal techniques; application of TQM tools.

## **Unit IV: Textile Manufacturing (20 questions)**

Classification and identification of fibres; structure and properties of fibres; Production of synthetic fibres – raw materials, wet, dry, melt, dry-jet spinning.

Objectives, principle of working and calculations – ginning, blow room, carding, draw frame, comber preparatory, comber, roving frame, ring frame, ring doubling, TFO, rotor, air-jet, air-vortex, friction, core and wrap spinning machines; helical geometry and packing density of yarn, yarn contraction, yarn twist vs. strength, structure-property relations of yarns.

Objectives, principle of working and calculations – winding, warping, sizing; principle of fabric formation in shuttle looms, rapier, air-jet, and projectile looms; Basic woven fabric structures and its derivatives; Pierce geometry of plain woven fabrics, structure-property relationship of fabrics.

Objectives, principle of working and calculations – circular, flat and warp knitting; basic weft and warp knitted structures; production of nonwovens – needle punch, spun lace, spun bond and melt blown. Safety measures in fibre, yarn and fabric manufacturing industry.

## **Unit V: Chemical Processing of Textiles and Quality Assurance (20 questions)**

Objectives and principles of desizing, singeing, scouring, bleaching and mercerizing machines; dyeing of different types of fibres, yarns and fabrics and the machines used; types and methods of printing; colour

and fastness measurement.

Principles and methods for shrink-proof, raising and calendaring, crease resistance, water-proof, water-repellent, flame retardant, soil release, UV resistance, anti-microbial, anti-static, softening, stiffening, elastomeric, self-cleaning finishes; eco-friendly processing, eco standards and eco labels, characteristics of effluent and effluent treatment.

Measurement of length, strength, fineness, maturity and trash of the cotton fibres; measurement of count, twist, strength and elongation, unevenness, imperfections and hairiness of the yarn; determination of construction parameters, tensile, tear, and bursting strength, air permeability, bending, drape, crease and wrinkle recovery, thickness, pilling and abrasion resistance and shrinkage of the fabrics; yarn defects analysis – diagram, spectrogram, Variance-length curve; fabric defects analysis.

Garment manufacturing – pattern making, marker planning, spreading, cutting, sewing and finishing; types of stitches and seams; garment inspection; fibre, yarn and fabric requirement for industrial, automotive, geo, agro, medical, protective and sports textiles.

Safety measures in chemical processing industry.

#### **Unit VI: Electrical Engineering (20 questions)**

Circuit elements – Kirchoff's Laws – Mesh and Nodal Analysis – Network Theorems and Applications for DC and AC circuits: Thevenin's Theorem, Norton's Theorem, Superposition Theorem, Maximum Power Transfer Theorem. Three phase Circuits, Star – delta transformation.

Coulomb's Law, Gauss's Law, Magnetic Circuits – Magnetomotive force- Reluctance – Faraday's laws – Lenz's law – Biot – Savart's law – Ampere's law – Fleming's left and Right Hand Rule - Lorentz force – Inductance – Self and Mutual Inductance – Dot Convention – Coupled Circuits.

D.C, Machines, Generators and Motors – Starting, Speed Control and braking – Testing Losses and Efficiency. Transformers – Types – Construction and Operation – Testing. Induction Machines Starting, Speed Control and braking Synchronous Machines, permanent magnet brushless DC motor, stepper motors

Circuit Breakers- protection; transformer, generator, motor, bus bars and transmission line – AC and DC Distribution – deregulation- energy conservation and energy auditing.

#### **Unit VII: Measurements, Control Systems and Power Electronics (20 questions)**

Measurement of Current, Voltage, Power, Power factor; Energy – Indicating instruments – Multi meters, Transducers and their applications to the Measurement of Non-Electrical Quantities like Temperature, Pressure, Flow-rate, Displacement, Acceleration, Noise level- Data Acquisition Systems – A/D and D/A converters – Data Transmission Systems – PLC – smart meters.

Control systems; Mathematical Modelling of Physical Systems, Transfer function, block diagram, signal flow graph and the reduction, PI, PD and PID Controllers –state. Semiconductor Devices

Power Semiconductor devices – single and Three Phase AC to DC Converters, Speed Control of DC Drives speed control of AC drives, induction motor drives.

#### **Unit VIII: Electrical Power Generation and Thermal Engineering (20 questions)**

Power Generation Types – Hydro, Thermal and Nuclear Stations, Co- generation, Renewable Energy, Solar energy, Wind Energy, smart grid – electric vehicles – V2G and G2V – Fuel cells – Batteries – types and characteristics – Super Capacitors.

Thermal engineering - basic concepts, Zeroth, First and Second laws of thermodynamics, thermodynamic system and processes, Emissions and Controls. I.C. Engines Refrigeration and air-conditioning: Vapour refrigeration cycle, heat pumps, gas refrigeration. Heat exchanger performance.

#### **Unit IX: Mechanical Engineering (20 questions)**

Properties of Surfaces and Solids, Centre of Gravity, Gears and Gear Trains, Fly Wheels and Governors, Balancing of Rotating and Reciprocating Masses, Friction in Machine Elements, Force Analysis, mechanisms for Vibration Control. Stress, Strain and Deformation of Solids, Fundamentals of Design for Strength and Stiffness of Machine Members, Spur Gears and Parallel Axis Helical Gears, Bevel Gears, Worm Gears and Crossed Helical Gears. Fluid properties, Bernoulli's equation, Pelton wheel, Francis and Kaplan turbines - pumps and its applications - Valves and Types

Production Flow Analysis, Industrial Robotics, lean manufacturing. Work study - Techniques, Method study - ABC Analysis material handling systems, Management theory and practice, planning - Decision making, Organising, staffing, Motivation, Leadership, controlling, control techniques, Industrial Safety - Standards – OSHA.

### **Unit X: Production Engineering (20 questions)**

Constitution of alloys and phase diagrams, heat treatment of ferrous and non-ferrous metal, surface modification techniques, powder metallurgy, non-metallic materials, mechanical properties and testing, crystal defects and strengthening mechanisms, Engineering ceramics, Engineering and commodity polymers, composites, nano-materials. Foundry Technology- Sheet Metal Operation welding defects, Casting, Welding Inspection (NDT), Machinability machine tools  
- CNC machine tools. Limits, Fits and Tolerance, Computer Aided Inspection, Machine vision, Measurement of power, flow and temperature. Statistical quality control, control charts, acceptance sampling, reliability, TQM, 5S, ISO standards. Fundamentals of Computer Graphics, Geometric Modeling, Production Planning and Control, Computer Aided Process Planning, Cellular Manufacturing, Flexible Manufacturing System and Automated Guided Vehicle System.

## **22. Library and Information Science (Degree Standard)**

**Code: 594**

### **Unit I: Library and Society (20 Questions)**

Library as a Social Institution; Impact of Libraries on Social, Political, Economical, and Cultural aspects, Community Engaged Librarianship, Laws of Library Science, History and development of Library movement in India.

- (i) Types of Libraries – Public, Academic and Special Libraries; Librarianship, Professional Ethics.
- (ii) Library Legislation; Public Library Act; Delivery of Books and News papers (Public Library) Act; Right to Information (RTI) Act and Digital Delivery mandates. Intellectual Property Rights – Copyright Act. Creative Commons and Open Licensing.
- (iii) Library associations and Professional bodies – United Nations Educational Scientific and Cultural Organization(UNESCO), International Federation of Library Association, (IFLA), American Library Association (ALA); Chartered Institute of Library and Information Professionals (CILIP); Indian Library Association(ILA); Indian Association of the Teachers of Library and Information Science (IATLIS).
- (iv) Role of government agencies in library development – Rajaram Mohanrai Library Foundation( RRRLF) ; University Grant Commission – Information and Library Network (INFLIBNET), National Digital Library of India( NDLI).

### **Unit II: Library Management (20 Questions)**

- (i) Management – Concept; Definition; School of Thoughts – Functions of Management; (POSDCORB); Library Authority and Committees.
- (ii) Library Sections and Routines – Collection development Policy: Issues- Selection, Acquisition; Technical, Maintenance, Circulation, Reference and Periodical, Preservation and Conservation of Library resources.
- (iii) Human Resource Management – Job Analysis, Job Description, Recruitment, Selection, Training, performance Appraisal, Motivation, etc.
- (iv) Financial Management – Budget – Types, Sources of income to various types of libraries, Physical facilities – Building and equipments ; Green Library
- (v) Library Records - Statistics; Reports

### **Unit III: Information Processing (Library Classification) (20 Questions)**

- (i) Library Classification – Concept; Definition; Need and Purpose.
- (ii) Library Classification – Various Schemes of classification – Colon Classification; Dewey Decimal Classification; Universal Decimal Classification and Library of Congress Classification.
- (iii) Structure of knowledge – Modes of Formation of Subject, - Canons and Laws
- (iv) Facet and Facet analysis – Fundamental categories (PMEST); Analytico- Synthetic approach, metadata-driven ontologies & RDA-aligned approaches.
- (v) Notation –Types; Characteristics and Functions. Call number and structure.

**Unit IV: Information Processing (Library Cataloguing) (20 Questions)**

- (i) Library Cataloguing – Concept; Definition; Need, Purpose and Functions.
- (ii) Library Catalogue – Types – Physical forms and Inner forms - Alphabetical, Classified, and Alphabetico - Classified; Trade catalogue.
- (iii) Cataloguing Standards – ISBDs; Cataloguing Codes – Classified Catalogue Code of Ranganathan, Anglo-American Cataloguing Rules.
- (iv) International Standards – MARC – CCF; UNIMARC; MARC21; Metadata ,Dublin core, RDA, BIBFRAME.
- (v) Subject Headings – Sears' List of Subject Headings, Library of Congress Subject Headings (LCSH), Centralised, Co-Operative Cataloguing and Union Cataloguing.

**Unit V: Information Sources (20 Questions)**

- (i) Information Sources – Types, Documentary and Non Documentary – primary, secondary, and tertiary; Print Vs. Electronic resources.
- (ii) Reference Sources: Dictionaries, Encyclopedias, Indexing and Abstracting Sources, Directories, Biographical Sources; Geographical Sources.
- (iii) Electronic Information Sources – E-Books, E-Journals, Databases, Theses and Dissertation; Bibliographic, Indexing and Abstracting, Citation and Full-text data bases.
- (iv) Open Access Resources and Commercial Resources – Discipline oriented sources – Medline; INSPEC; etc; UGC - e- Sodhsindhu, ONOS, Sodhganga.
- (v) Evaluation of Information sources - Print and Web Resources; Multimedia; Open Access Resources.

**Unit VI: Information Services (20 Questions)**

- (i) Information Services - Types: Ready reference and Long range reference services; User education; Information literacy.
- (ii) Literature search – Bibliography compilation and Bibliographical services.
- (iii) Current Awareness Service (CAS), Selective Dissemination of Information (SDI), Rich Site Summary (RSS), E-Alert & Web based Services, Artificial Intelligence-driven services, Makerspace.
- (iv) Indexing and Abstracting services; Referral Service, Reprography service.
- (v) Translation and other specialized services, Library services for Differently Abled People data services, Mobile Services.

**Unit VII: Computer and Computer Applications (20 Questions)**

- (i) Computer – Definition; Characteristics; Classification of Computers Hardware – Generations; Input and Output Devices; Secondary Storage Devices; Tele communication – Concept and Components.
- (ii) Computer Software – Meaning; Types – System Software and Application Software; Operating System – Single user vs. Multi-user; Open Sources vs Proprietary.
- (iii) Database – Concept; Database Management System (DBMS) – Concepts; Functions.
- (iv) Library Automation - Need and Purpose; Areas of library automation; Library automation software packages – Proprietary vs Open.
- (v) Web Technology – Browser, Search Engine, Protocol, Integrated Services Digital Network (ISDN), Semantic web.

**Unit VIII: Resource Sharing and Networking (20 Questions)**

- (i) Resource sharing – Concept, Definition, Need, Purpose; Digital Inter-library loan (ILL).
- (ii) Library Co-operation – Concept, Definition, Need and Purpose.
- (iii) Computer Networks – Types – LAN, WAN, MAN; Internet and Intranet.
- (iv) Library Networks – Concept, Need, Functions.
- (v) Library Network System – International, Online Computer Library Center (OCLC), World cat; National – INFLIBNET, DELNET.

**Unit IX: Information System (20 Questions)**

- (i) Information System – Concept, Characteristics and Functions.
- (ii) Information System, Types – International, National; Subject – Mission Oriented; National Knowledge Commission; National Mission on Libraries.

- (iii) Information Systems – International - United Nations Educational, Scientific and Cultural Organization (UNESCO), International Nuclear Information System (INIS), International System for Agricultural Science and Technology (AGRIS), Information Service in Physics, Electro technology and Control (INSPEC), Open Access Infrastructure for Research in Europe (OpenAIRE); National - National Institute of Science Communication and Information Resources (CSIR-NIScPR) , National Information System in Science and Technology (NISSAT) - Defence Scientific Information & Documentation Centre (DESIDOC).
- (iv) Library Consortia – Trends, Functions; University Grant Commission UGC – e-sodhsindhu, *One Nation One Subscription (ONOS)* Council of Scientific and Industrial Research (CSIR) Consortium.
- (v) Open Access movement; Open Access System. Open Licensing, Creative Commons.

#### **Unit X: Digital Library and Information Communication Technology Applications (20 Questions)**

- (i) Digital Library – Concept, Definitions, Characteristics, Theoretical framework, Merits and Demerits. Digital Library Management – Design, Architecture, Standards.
- (ii) Digital Library Initiatives – Initiatives in India; Open Archives Initiatives. National Digital Library of India (NDLI), Shodhganga, India stat.
- (iii) Metadata – Definition, Standards, Metadata Harvesting. Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH), Interoperability with global harvesters (CORE, Europeana).
- (iv) Digital Library – Building process – Digitization; Software and Hardware; Institutional repositories.
- (v) Library Security Technologies – CCTV, SMARTCARD, Barcode, QR Code, Radio Frequency Identification (RFID), Biometrics, Emerging Trends in Library Services.

### **23. Mechanical, Production and Manufacturing Engineering (Degree Standard)**

**Code: 399**

#### **Unit I: Mechanics, Kinetics and Dynamics (18 Questions)**

Statics of Particles, Equilibrium of Rigid bodies, Mechanism of Deformable Bodies, Properties of Surfaces and Solids, Centroid, Centre of Gravity, Dynamics of Particles, Elements of Rigid Body Dynamics, Basics of Mechanisms, Kinematics of mechanisms, gyroscope, Gears and Gear Trains, Fly Wheels and Governors, Balancing of Rotating and Reciprocating Masses, Friction in Machine Elements, Force Analysis, Balancing, Single Degree Free Vibration, Forced Vibration, mechanisms for Vibration Control, Effect of Damping, Vibration Isolation, Resonance, Critical Speed of Shaft.

#### **Unit II: Strength of Materials and Design (20 Questions)**

Stress, Strain and Deformation of Solids, Combined Stresses, Theories of Failures, Transverse Loading on Beams, Stresses in Beams, Torsion, Deflection of Beams, Energy Principles, Thin Cylinders and Thick Cylinders, Spherical Shells, Fundamentals of Design for Strength and Stiffness of Machine Members, Design of Shafts and Couplings, Design for Static and Dynamic Loading, Design of Fasteners and Welded Joints, Reverted Joints, Design of Springs, Design of Bearings, Design of Flywheels, Design of Transmission Systems for Flexible Elements, Spur Gears and Parallel Axis Helical Gears, Bevel Gears, Worm Gears and Crossed Helical Gears, Design of single and two stage speed reducers, Design of cam, Clutches and Brakes, Design of Piston and Connecting Rods.

#### **Unit III: Fluid Mechanics and Turbo Machinery (20 Questions)**

Fluid properties, fluid statics, manometry, buoyancy, control volume analysis of mass, momentum and energy, fluid acceleration, differential equations of continuity and momentum, Bernoulli's equation, Dimensional Analysis, viscous flow of incompressible fluids, boundary layer, elementary turbulent flow, flow through pipes, head losses in pipes, bends. Turbomachinery: Pelton wheel, Francis and Kaplan turbines - impulse and reaction principles – velocity diagrams, pumps and its applications-Valves and Types - Theory of Jet Propulsion- Pulse Jet – Ram Jet Engines, Online Continuous Flow Monitoring System.

#### **Unit IV: Thermal Engineering and Thermodynamics (30 Questions)**

Basic concepts, Zeroth, First and Second laws of thermodynamics, thermodynamic system and processes, Carnot cycle. irreversibility and availability, behaviour of ideal and real gases, thermodynamic relations, properties of pure substances, calculation of work and heat in ideal processes, analysis of thermodynamic

cycles related to energy conversion, Fuel and combustion, Fuels Characteristics, Emissions and Controls, Testing of IC Engine-Renewable sources of Energy.

Power Engineering: Steam Tables, Rankine, Brayton cycles with regeneration and reheat. I.C. Engines: air-standard Otto, Diesel cycles. Refrigeration and air-conditioning: Vapour refrigeration cycle, heat pumps, gas refrigeration, Reverse Brayton cycle; moist air: psychometric chart, basic psychometric processes.

#### **Unit V: Heat and mass Transfer (25 Questions)**

Modes of heat transfer - one dimensional heat conduction, resistance concept, electrical analogy, unsteady heat conduction, fins dimensionless parameters in free and forced convective heat transfer, various correlations for heat transfer in flow over flat plates and through pipes, thermal boundary layer, effect of turbulence, radiative heat transfer, black and grey surfaces, shape factors, network analysis; heat exchanger performance, LMTD and NTU methods.

Basic Concepts of Mass transfer, Diffusion Mass Transfer, Fick's Law of Diffusion Steady state Molecular diffusion, Convective Mass Transfer, Momentum, Heat and Mass Transfer Analogy, Convective Mass Transfer Correlations, Radiative Heat Transfer.

#### **Unit VI: Materials Science and Metallurgy (25 Questions)**

Constitution of alloys and phase diagrams, Iron – Iron Carbide Phase Diagram - steels, cast iron, phase transformations- diffusion-TTT diagram, ferrous and nonferrous alloys, heat treatment of ferrous and non-ferrous metal, surface modification techniques, powder metallurgy, non-metallic materials, mechanical properties and testing, crystal defects and strengthening mechanisms, conducting and semi conducting materials, magnetic and dielectric materials, Engineering ceramics, Engineering and commodity polymers, composites, nano-materials.

#### **Unit VII: Production Technology (22 Questions)**

Foundry Technology- types of pattern, cores, moulding and casting methods, Solidification, design of castings, defects, Melting Furnaces, Hot and Cold working, Metal Forming Processes - types, Defects and Remedies, Sheet Metal Operation, metal joining processes, types and design of weldment, welding metallurgy, welding defects, Casting, Welding Inspection (NDT), Manufacturing of Thermo Setting and Thermo Plastic Products, Metal cutting, Cutting Tool Nomenclature, Machinability machine tools - center lathe, drilling, milling, grinding, gear cutting and broaching, Machining Time Calculation, unconventional machining processes, Micro Manufacturing, CNC machine tools, Manual Part Programming - Machining and Turning Centre.

#### **Unit VIII: Metrology and Quality Control (15 Questions)**

Limits, Fits and Tolerance, Linear and angular measurements, Interferometry, laser interferometers - Types, Computer Aided Inspection, Basic concept of CMM - Types of CMM, Machine vision, Form measurement-Straightness- Flatness, Roundness, Surface finish measurement, contact and non-contact method, Measurement of power, flow and temperature. Statistical quality control, control charts, acceptance sampling, reliability, TQM, 5S, ISO standards.

#### **Unit IX: CAD / CAM / CIM / FEA (13 Questions)**

Fundamentals of Computer Graphics, Geometric Modeling, Visual Realism, Assembly of Parts, CAD Standards, Fundamentals of CIM, Production Planning and Control, Computer Aided Process Planning, Cellular Manufacturing, Flexible Manufacturing System and Automated Guided Vehicle System, Group Technology, Production Flow Analysis, Industrial Robotics, Additive Manufacturing, Just in Time(JIT), lean manufacturing, One Dimensional Problems in FEA, Two Dimensional Scalar Variable Problems, Two dimensional vector variable problems, Isometric Parametric Formulation.

#### **Unit X: Industrial Engineering and Management (12 Questions)**

Work study - Techniques, Method study and work measurements - objectives - basic procedure, machine loading and scheduling, product sequencing, inventory control - E O Q - quantity discounts, ABC Analysis material handling systems, operations research, Linear Programming, simplex method, Transportation model, Assignment model CPM and PERT, Queuing Models. Management theory and practice, planning - Decision making, Organising, staffing, Motivation, Leadership, controlling, control techniques, Industrial Safety - Standards – OSHA.

**24. Pharmacy, Clinical Pharmacology and Micro Biology**  
**Degree Standard**

**Code: 516**

**Unit I: (20 Questions)**

**1) Historical background and development of profession of pharmacy:** History of profession of Pharmacy in India in relation to pharmacy education, industry and organization, Pharmacy as a career, Pharmacopoeias: Introduction to IP, BP, USP and Extra Pharmacopoeia.

**2) Calculations:**

**Posology:** Pediatric Dose calculations based on age, body weight and surface area.

**Pharmaceutical calculations:** Percentage solutions, Alligation, Proof spirit and isotonic solutions based on freezing point and molecular weight.

**3) Unit Operations:** Size reduction, Size separation, Mixing, Filtration, Centrifugation, Evaporation, Drying, Distillation, Heat transfer, Tablet Compression and Tablet coating.

**4) Coarse Dispersion:**

Suspension, interfacial properties of suspended particles, settling in suspensions, formulation of flocculated and deflocculated suspension. Emulsions and theories of emulsification, micro emulsion and multiple emulsion, stability of emulsions, preservation of emulsions, rheological properties of emulsions and emulsion formation by HLB method.

**5) Pre-formulation studies:** Introduction to pre-formulation, goals and objectives, study of physicochemical characteristics of drug substances

**a. Physical Properties:** Crystal & amorphous form, particle size distribution and determination, shape, flow properties, derived properties, solubility profile (Pka, pH, Partition co-efficient) Polymorphism.

**b. Chemical properties:** Hydrolysis, Oxidation, reduction racemisation, polymerisation.

BCS classification of drugs and its significant

Application of preformulation considerations in the development of solid, liquid oral and parenteral dosage forms and its impact on stability of dosage forms.

**6) Pharmaceutical Excipients** – Used in Liquid, Semisolids and Solid dosage forms.

**7) Quality Control Tests of the following formulations:** Oral Solid dosage forms, Semi solids, Oral Liquid dosage forms, Parenteral, Ophthalmic preparation and Pharmaceutical Aerosols.

**8) Cosmetics:** Formulation and preparation of the following cosmetics preparations- Lipsticks, Shampoos, Cold Cream, Vanishing Cream, Tooth Paste, Hair Dyes, Sunscreens.

**9) Packaging Material Sciences:** Materials used for packaging of Pharmaceutical products, factors influencing choice of containers, legal and official requirement for containers, Quality control tests for containers and rubber closures.

**10) Bio availability and Bioequivalence:** Definitions and objectives of Bioavailability, absolute and relative bioavailability, measurement of bioavailability, in-vitro drug dissolution models, in-vitro-in-vivo correlations, bioequivalence studies, methods to enhance dissolution rates and bioavailability of poorly soluble drugs.

**Unit II: (15 Questions)**

**1) Pharmacokinetics:** Definition and introduction of Pharmacokinetics, Compartment models, Non-compartment models, Physiological models, One compartment open model

a) Intravenous Injection (bolus)

b) Intravenous infusion

c) Extra vascular administrations.

Pharmacokinetic parameters – Elimination rate constant ( $K_E$ ), Half life ( $t_{1/2}$ ), Volume of distribution (Vd), Area under curve (AUC), Absorption rate constant ( $K_a$ ), Total body clearance ( $CL_t$ ) and Renal Clearance ( $CL_R$ ) – definitions, methods of elimination, understanding of their significance and application.

**2) Good manufacturing practices (GMP)**

**3) Good Laboratory Practices (GLP):** Organisation and personnel, Facilities, equipment, Testing facilities operation, Test and control articles, Protocol for conduct of a Nonclinical Laboratory Study, Records and reports, Disqualification of Testing facilities.

**4) Warehousing:** Good Warehousing practice, Materials Management.

**5) Quality management systems:** Quality management and certification: concept of quality, Total Quality Management, Quality by Design (QbD), Six Sigma concept, Out Of Specifications (OOS), Change control, Introduction to ISO 9000 series of quality system standards, ISO 14000, NABL.

**6) Over the counter (OTC) Sales:** Introduction and sale of over the counter and Rational use of common over the counter medications.

**7) Drug Store Management and Inventory Control:** Organisation of Drug Store, types of materials stocked and storage conditions. Purchase and inventory control: Principles, Purchase procedures, Purchase order, Procurement and stocking, Economic order quantity, Reorder quantity level and methods used for the analysis of the drug expenditure.

**8) Novel Drug Delivery Systems:** Ocular Drug Delivery Systems, Transdermal Drug Delivery Systems, Implantable Newer Drug Delivery Systems, Targeted Drug Delivery and Controlled Drug Delivery Systems.

**9) Blood products and Plasma Substitutes:** Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substitutes

**10) Fermentation** methods and general requirements, study of media, equipments, sterilization methods, aeration process, stirring. Large scale production fermenter design and its various controls. Study of the production of – Penicillins, Citric acid, Vitamin B12, Glutamic acid, Griseofulvin.

### **Unit III: (15 Questions)**

#### **General Microbiology & Immunology**

1. Morphology, classification and identification of Bacteria, Virus, Fungus & Parasite
2. Normal microbial flora & Bacterial genetics
3. Culture Media & Equipments in Microbiology Laboratory
4. Sterilization and disinfection
5. Testing of Sterilization & disinfection including sterility testing of pharmaceutical products.
6. Bio Safety in Microbiology Laboratory
7. Cultivation of Bacteria
8. Structures, Cells and functions of Immune system
9. The complement system
10. Antigen-Antibody reactions
11. Hypersensitivity
12. Tumour Immunity & Immuno Haematology
13. Immuno Prophylaxis against infectious Diseases
14. Immunotherapy

### **Unit IV: (20 Questions)**

#### **Clinical & Applied Microbiology**

1. C.N.S infections
2. Respiratory Infections
3. Urinary Tract Infections
4. Gastro intestinal Infections
5. Genital Tract Infections
6. Congenital Infections
7. Infections of Eye, Ear & Skin
8. Infections of Cardio vascular System
9. Pyrexia of Unknown Origin (P.U.O)
10. Zoonotic Infections
11. Collection, Transport and Disposal of Specimens
12. Environmental Microbiology (Food, Water, Milk and Air)
13. Microbial Control – anti microbial susceptibility testing
14. Microbiological Assays for Standardisation of Antibiotics and Vitamins
15. Bio medical waste management
16. Emerging and reemerging infections – Bio Terrorism
17. Advanced Molecular Techniques in Relation to Diagnosis of Infectious diseases & Basic molecular biology related to infections
18. Anti microbial resistance and antibiotic policy
19. Newer Vaccines
20. Quality Control, Audit and Accreditation of Standard Microbiology Laboratory.

### **Unit V: (15 Questions)**

1. Atomic structure and valency, Radioactivity, Radio isotopes and Pharmaceutical applications of Radio Pharmaceuticals, hazards and precautions.
2. Sources of impurities in Pharmaceutical substances: Limit test as per I.P; Fundamentals of volumetric Analysis. Errors: Sources, types, methods of minimizing errors, Accuracy, Precision, significant figures.
3. A systematic study of inorganic compounds for their preparation, assay and use which includes Gastrointestinal agents, Topical agents and Dental products.
4. Preparation and use of Chemical reagents and Volumetric Solutions as per Pharmacopeia in Pharmaceutical Analysis.

### **Unit VI: (25 Questions)**

1. Principles and Pharmacopoeial Assay Procedures involving Non-aqueous Titration, Redox, Diazotization, complexometric methods, electrometric titration, gravimetric analysis.
2. Chromatography – Thin Layer Chromatography (TLC), Column, Paper, Gas Chromatography (GC), Ion exchange, High Performance Liquid Chromatography (HPLC), High Performance Thin Layer Chromatography (HPTLC), Gel electrophoresis.
3. Theory, principle, instrumentation and applications of colorimetry, UV-Visible Spectrophotometry, Spectrofluorimetry, Nepheloturbidometry, Infra-Red (IR), Mass, Nuclear Magnetic Resonance (NMR), Radio Immuno Assay (RIA), Polarimetry, Refractometry, Thermal method of analysis – Thermo Gravimetric Analysis (TGA), Differential Scanning Calorimetry (DSC), Differential Thermal Analysis (DTA), Atomic absorption spectroscopy.
4. ICH guidelines – Calibration and validation, calibration of electronic balance, UV spectrophotometer, IR spectrophotometer, Fluorimeter, High Performance Liquid Chromatography (HPLC), Gas Chromatography (GC), Flame photometer.

### **Unit VII: (20 Questions)**

#### **1) General Pharmacology**

Sources of drugs, Routes of drug administration, Dosage formulations, Pharmacokinetics, Pharmacodynamics - Good Clinical Practice- Patient compliance, and self medication, Placebo medicines and pharmacoeconomics.

Discovery and development of drugs - Preclinical studies in animals - Clinical trials - Official regulatory guidelines.

Orphan drugs, Pharmacovigilance – Pharmacogenetics - Adverse drug reactions and monitoring - Clinical importance of drug interactions (both pharmacokinetic and pharmacodynamic interactions with special reference to antimicrobials, NSAIDs and cardiovascular drugs).

#### **2) Drugs Acting on Nervous System – Central Nervous System**

General anaesthetics and Pre anaesthetic medication – Antiepileptics – Sedatives and Hypnotics – Alcohols and disulfiram – Psychopharmacological drugs (Anti-Psychotics, Anti-depressants, anti-anxiety agents, anti-manic and hallucinogens) – CNS Stimulants – Neurodegenerative disorders – Deaddiction – Drugs of abuse, drug tolerance and drug dependence.

#### **3) Peripheral Nervous System & Autonomic Nervous System**

Neurohumoral transmission in Autonomic nervous system, Para Sympathomimetics, Parasympatholytics, Sympathomimetics, Sympatholytics, neuromuscular blocking agents, Skeletal muscle relaxants (peripheral), Local anaesthetic agents, Drugs used in Myasthenia gravis and glaucoma.

#### **4) Cardiovascular Drugs**

Drugs used in congestive heart failure, Anti-hypertensive drugs, Anti-Anginal Drugs, Anti-arrhythmic drugs, Hypolipidemic Drugs, Drugs used in the therapy of shock.

#### **5) Drugs Acting on Hemopoietic and Renal System**

Haematinics - Coagulants & Anticoagulants – Fibrinolytics & Antifibrinolytics – Antiplatelets– Diuretics.

### **Unit VIII: (20 Questions)**

#### **1) Drugs Acting on the Gastro Intestinal System**

Anti-ulcer agents, Drugs for constipation and diarrhea, appetite stimulants and Suppressants, Digestants and carminatives, Emetics and anti-emetics.

## 2) Drugs Acting on Endocrine System

Anterior pituitary Hormones - Thyroid Hormones – Corticosteroids - Insulin & Oral Hypo glycaemic drugs  
- Male & Female sex Hormones - Oral contraceptives - Uterine stimulants & relaxants.

## 3) Immunopharmacology & Autacoids

Cell and biochemical mediators involved in allergy, immuno modulation and inflammation, hypersensitivity reactions - therapeutic agents for allergy, asthma and COPD - NSAIDs & DMARDs & gout – Antihistamines  
- Serotonin agonists & Antagonists.

## 4) Chemotherapy

General Principles of Chemotherapy, Sulfonamides and co-trimoxazole, Anti-biotics: Penicillins, Cephalosporins, Chloramphenicol, macrolides, Quinolones and fluoroquinolones, tetracycline and amino glycosides, Anti-tubercular agents, Anti-leprotic agents, Anti-fungal agents, Anti-viral drugs, Anthelmintics, Anti-malarial drugs, Anti-amoebic agents, Urinary tract infection and sexually transmitted diseases, Chemotherapy of malignancy.

## 5) Bio-Assay

Principles and applications of Bio-assay, types of bio-assay, bio-assay of insulin, oxytocin, Vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5HT.

## 6) Miscellaneous

Vaccines - Dermatological preparations - Chelating Agents.

## Unit IX: (20 Questions)

1. Alphabetical, Morphological, Taxonomical, Chemical and Pharmacological classification of crude drugs.
2. Adulteration and evaluation of drugs of natural origin. WHO guidelines for the assessment of herbal drugs.
3. General introduction, composition, chemistry and chemical classification, general methods of extraction and analysis, bio-sources, therapeutic uses and commercial application of following secondary metabolites.
  - a. Alkaloids - Vinca, Rauwolfia, Belladonna, Opium
  - b. Steroids, Cardiac Glycosides and Triterpenoids - Liquorice, Dioscorea, Digitalis
  - c. Glycosides - Senna, Aloes
  - d. Tannins - Black & Pale catechu
  - e. Volatile oils - Mentha, Clove, Cinnamon, Fennel, Coriander
  - f. Resins - Benzoin, Ginger, Asafoetida, Colophony
4. Isolation, Identification and Analysis of following phytoconstituents
  - (i) Terpenoids- Menthol, Citral, Artemisin
  - (ii) Glycosides -Glycyrrhetic acid, Rutin
  - (iii) Alkaloids - Atropine, Quinine, Reserpine, Caffeine
  - (iv) Resins - Podophyllotoxin, Curcumin
5. Homeopathy: Introduction, Basic principles, Preparation and evaluation of Various Dosage forms of homeopathy system of medicine
6. Marine Drugs: Novel Medicinal agent from marine sources.
7. Herbal Cosmetics: Sources and description of raw material of herbal origin used via, fixed oils, waxes, gums, colours, perfumes, protective agents, bleaching agents, antioxidants in product such as skin care, hair care and oral hygiene products.

## Unit X: (30 Questions)

1. The Drugs and Cosmetics Act, 1940 (As Amended from time to time)
2. The Drugs Rules 1945 (As Amended from time to time)
3. The Cosmetics Rules, 2020 (As Amended from time to time)
4. The Medical Devices Rules, 2017 (As Amended from time to time)
5. The New Drugs and Clinical Trials (NDCT) rules, 2019 (As Amended from time to time)
6. The Drugs (Price Control) Order 2013 (As Amended from time to time)
7. The Pharmacy Act, 1948 (As Amended from time to time)
8. The Drugs and Magic Remedies (Objectionable Advertisement) Act, 1954 and Rules, 1955 (As Amended from time to time)
9. The Narcotic Drugs and Psychotropic substances Act and Rules, 1985 (As Amended from time to time)

**25. Physics, Chemistry, Biology, Computer Science and Forensic Science  
(PG Degree Standard)**

**Code: 575**

**Unit I: Fundamentals of Physics (20 Questions)**

Impulse - Impact - Laws of Impact - Loss of Kinetic theory - Motion of two interacting bodies - Reduced mass - Rigid body dynamics. **Relativity:** Postulates of Special theory of relativity - Mass Energy Equivalence. **Space Physics:** Escape Velocity - Orbital Velocity - Geo Stationary Orbits and Satellite Communication - Remote Sensing.

Basic ideas of Interference, Diffraction and Polarisation - Principle of LASER and its applications - Coupling Schemes - Zeeman effect - Paschen Back effect - Rotation, Vibration and Rotation - Vibration Spectra - Frank Condon principle - Laws of thermodynamics - Entropy - Thermodynamic potentials - Maxwell's equations and its applications, Gibb's phase rule - Phase transition - Vanderwaal's equation of State.

Crystal Classes and Systems - 2D, 3D Lattices - Lattice heat capacity - X-rays - X-ray diffraction - Superconductivity - Super Conductors, Different types of magnetic materials - Binding energy - Propagation of electromagnetic waves in non conducting and conducting medium - Reflection and refraction at a plane interface between dielectrics - Radiation from a localised source. - Fourier transform infrared, Raman, NMR and ESR spectroscopy- Principle, technique and applications

**Unit II: Electronics (20 Questions)**

Ampere's circuital law and its application - theory of Ballistic Galvanometer - Potentiometer - measurement of current, voltage and resistance. Semiconductor diode and transistor - Optoelectronic devices - Photo diode, Photo transistor, LDR, LED, LCD, Special Semi conductor devices - JFET, MOSFET, UJT- Operational amplifier - Characteristics and applications - 555 timer. Logic gates - Half and Full adder and subtractors - Karnaugh map - NAND - NOR networks - flipflops - counters and shift registers - Active Filters - Analog to digital and digital to analog converter.

Modulation and demodulation techniques - Principle of radio communication - AM and FM transmission - RADAR Principle - Television transmission and reception - Propagation of Light in an Optical fibre. ECG and EEG techniques - Basic ideas of CT and MRI Scan.

**Unit III: General Chemistry (20 Questions)**

**Reaction Kinetics:** Rate laws - rate constant - order and molecularity of reactions - I, II, III, and zero order reactions - concept of Arrhenius theory - Collision theory and Transition state theory - catalysis.

**Acids and Bases:** Bronsted and Lewis acids and bases - pH and pKa acid - base concept in non - aqueous media - HSAB concept - Buffer Solutions. Redox Reactions: Oxidation numbers, Redox potential, Electro chemical series - application of EMF measurements - Redox indicators.

**Structure and Bonding:** Electronic configuration of atoms, periodic properties of elements, Ionic radii, ionization potential electron affinity, electro negativity, concept of Hybridization, molecular orbitals and electronic configuration of homo nuclear and hetero nuclear diatomic molecules, shapes of polyatomic molecules. Types of chemical bond (weak and strong) inter molecular forces, structure of simple and covalent bonds - covalent character in ionic bond and partial ionic character - lattice energy.

**Organic Reaction Mechanism:** SN1, SN2 mechanisms - addition substitution, elimination and rearrangements - free radical mechanism - aromatic substitution - and stability of reactive intermediate (Carbocations, Carbanion's free radicals, nitrates and benzyne) - Polar effects - Hammett's equation and its modification.

**Stereochemistry:** Optical and geometric isomerism E. Z and R.S notation's IUPAC Nomenclature of simple organic and inorganic compounds.

**Unit IV: Chemical and Instrumental Analysis (20 Questions)**

**Titrimetric Analysis:** Classification of reaction in titrimetric analysis - Standard Solutions - Normality, Molarity and Molality - concentration units - Primary and Secondary standard - neutralization indicators - self indicators and external indicators - acid base titrations - precipitation titrations - redox titrations.

Qualitative Analysis: Semimicro qualitative analysis of cations like Se, Te, W, Mo, Ce, Th, Zr, V, Ca, Ba, Ni, and Mg.

Basic Principles, Instrumentation and applications of Ultraviolet-visible (UV-vis.) spectroscopy; Beer-Lambert's law, solution preparation and small molecules analysis and Flow Injection analyzer - Nuclear Magnetic spectroscopy (NMR), small molecule analysis. Flame spectrometry, Atomic Absorption Spectroscopy (AAS), Inductively Coupled Plasma - Mass Spectrometry (ICP-MS), Inductively Coupled

Plasma Emission spectroscopy, Fluorimetry-Chemiluminescence's Detector system, X-ray fluorescence spectroscopy (XFS),

Chromatographic Techniques: Basic Principles of chromatography, Instrumentation and application of chromatography - Paper, thin layer chromatography (TLC), High-performance Liquid chromatography (HPLC) and Gas chromatography (GC), Gas-Chromatography with Mass Spectrometer (GC-MS), Liquid Chromatography with Mass spectrometry (LC-MS).

### **Unit V: Zoology (20 Questions)**

Salient features of Invertebrata and Vertebrata - Structural Organization of animal cell - Types of Muscle - Blood and its composition- grouping - Blood cells - Structure of sperm and Egg. Human genetics - Pedigree analysis - Karyotyping - Chromosome structure and functions - Beneficial and harmful insects - Exploiting insects olfaction in forensic studies - Ants, blowflies and beetles in forensic investigation. Anthropology scope - Basic concepts, types - Applied and developmental Anthropology - Forensic anthropology and criminal investigations. DNA finger printing technology in forensic investigations. Chemistry of Biomolecules - Types of carbohydrates, proteins and lipids. Metabolism of Bio molecules - Nucleic acids - Types, Structure and functions of DNA & RNA, Enzymes - Properties - Marker enzymes - Classes and function of Hormones - Pheromones. Theories of Origin of life.

### **Unit VI: Botany (20 Questions)**

**Plant Diversity:** Salient features and economic importance of Algae, Fungi, Lichens, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.

**Cell Biology:** Cell Organelles and its functions. Cell cycle, Cell division, Tissuesystem and secondary growth

**Plant pathology:** Bacterial, fungal and viral diseases of plants.

**Embryology:** Micro sporogenesis, Megasporogenesis, Polyembryony, Doublefertilization.

**Genetics:** Mendelism, Linkage, crossing-over, chromosome mapping.

**Plant adaptations:** Hydrophytes, Xerophytes, Mesophytes, Epiphytes, Halophytes and Mangrove vegetation. Biodiversity conservation methods.

**DNA profiling:** Genetic code, Mutation and DNA polymorphism, Recombinant DNA technology.

**Isolation of DNA:** Agarose Gel Electrophoresis, PCR, DNA Sequencing, RAPD, RFLP, DNA Finger printing, STR Typing.

**Isolation of Proteins:** SDS-PAGE, RIA, ELISA, FISH. Ames test, Comet Assay.

**Microbiology:** Microscope and its types. Histology and Staining techniques. Microbial culture and preservation techniques. Host-parasite interaction, Microbial diseases, Bioterrorism and Biohazards.

### **Unit VII: Computer Fundamentals and Applications (20 Questions)**

Computer Peripherals-Operating System Fundamentals- File Systems & Management -Processors – Memory Devices - Network Fundamentals- Word Processing- Spread Sheets- Power Point Presentation- Database Fundamentals - Web Fundamentals - Browsers-Hypertext Markup Language (HTML) - Java Script- Web pages - Internet- Cloud Services- AIFundamentals and its Applications- Cyber Security - Authentication - Firewalls-E-Commerce Applications- Data Protection- Messaging Tools -Mail Services - Internet of Things (IoT).

### **Unit VIII: Fundamentals of Forensic Science and Crime Scene Investigation (20 Questions)**

Forensic science - Definition- Organisation and functions of Forensic laboratory- Foot and tire Impressions: Walking pattern- Finger prints: principles, patterns,classification - Identification of tool marks- Firearms, bullet and cartridge case identification, Pellets and Wads - Fire and Arson - Explosives;classification- Combustion, detonation and explosion- Military and Industrial Explosives - Physical evidence,classification and significance- Crime scene examinations- Documentation-recognition, collection, preservation of transportation for laboratory examinations- Fundamentals of Crime Scene Photography.

### **Unit IX: Advanced Forensic Techniques in Documents, Toxicological and Bio-Evidence (20 Questions)**

Questioned documents: Identification of Hand writing, Typed and Forged signatures - Broken glass: glass fractions, direction of force - Forensic examination of soil and paints, polygraph and voice identification- Toxicology: classification, mode of action of poison - Narcotic drugs, alcoholic beverages- Examination of biological fluids: blood, seminal, vaginal and saliva stains-Examination of fibres, hair, bones, nail, teeth, tissues and skull.

### **Unit X: Criminology, Penology and Victimology (20 Questions)**

Concept of Crime - Nature and its Scope - Typology and Patterns of Crime - Schools of Criminology - Causation of Crime- Theories of Crime: Psychological, Sociological and Tentative- Crime and Economic Conditions - Media , Race and Crime- Organised Crimes - White Collar Crimes - Cyber Crimes - Sexual Offenders - Green and Environmental Criminology - Alcoholism , Drug Addiction and Crime - Crimes of the powerful - Methods and Counting Crime - Crime Statistics - Punishment: Theories, Forms of Punishment and Judicial Sentencing - Capital Punishment - Criminal Law Courts - Prisons - Parole - Juvenile Delinquency - Crime Prevention - Victimology: Branches of Victimology - Restorative Justice - Risk and Protective factors - Formal and Informal responses to victimisation - Victims: Victimisation Cycle - Stages, Effects and Theories of Victimisation

## **26. Statistics and Mathematics (PG Degree Standard)**

**Code: 506**

### **Unit I: Probability and Distribution Theory (25 Questions)**

Random variables and Distribution function, Distribution function of a random vector – Mathematical expectation and conditional expectation  
Chebychev's inequality – Convergence in probability – Convergence in distributions – Weak and Strong laws of large numbers – Central limit theorems (Lindeberg-Levy, Liapunov's)  
Introduction to distributions:  
Discrete distributions: Negative binomial and Hyper geometric distributions  
Continuous distributions: Cauchy, Beta, Gamma, Weibull and Log-Normal.  
Sampling distributions: Non central t, F and Chi-square distributions and their properties – Bivariate Binomial, Poisson Normal and their properties.

### **Unit II: Estimation Theory and Testing of Hypotheses (25 Questions)**

Introduction to estimation theory and properties of estimators.  
Theorems and inequalities: Cramer – Rao inequality, Batacharya inequality, Rao – Blackwell, Neyman – Fisher factorization theorems with examples.  
Methods of estimation: Method of moments, Maximum likelihood, Minimum Chi-Square and method of least squares, Bayesian estimation – Introduction - Point and interval estimation and Bayes estimator under squared error loss function.  
Introduction to testing of hypotheses: Basic concepts – More powerful Test - Neyman – Pearson lemma: UMP and unbiased tests – MLR property and its uses for construction of UMP tests.  
Non-Parametric tests: Run test, Median test, Mann-Whitney test, Wilcoxon test, Kolmogoro-Smirnov test (one and two sample test procedures), Kruskal-Wallis test and SPRT test

### **Unit III: Regression analysis (20 Questions)**

Introduction to linear regression model – Simple and multiple regression models: Description of data model – Estimation and testing of hypotheses on regression coefficients – Adequacy measures – Predicted values and standard error – Evaluation of fit – Analysis of residuals.  
Multicollinearity and its effects on inference and forecasting – Selection of variables – Forward selection procedure (step-wise method).  
Introduction to Generalized Linear Models: Components of GLM – Logistic regression model- Classification in two population, Fitting and interpretation.

### **Unit IV: Sampling Theory and Design of Experiments (25 Questions)**

Ratio and Regression estimators, estimation under double sampling – Cluster sampling – Two stage sampling – Sampling and Non sampling errors.  
Contrasts: Linear and orthogonal contrasts – Linear models: Fixed, random.  
Principles of experimental designs – Construction and analysis of  $2^3$  and  $3^2$  fractional experiments – Partial and complete confounding – BIBD - PBIBD (Two Associates only) - Youden Square design.

### **Unit V: Statistical Quality Control and Time series (15 Questions)**

Acceptance sampling: Sampling inspection – AOQL, LTPD, Producers' and consumers' risks – Single, double, sampling plans for attributes and variables – OC, ASN, ATI and AOQ curves. Six sigma –

Overview and implementation.

Time series – Components, uses – Determination of trend by Method of moving averages, fitting of first and second order degree, seasonal indices and the estimate of the variance for random components, autoregressive, moving averages and ARIMA models.

#### **Unit VI: Machine Learning Techniques through R and Python Languages (10 Questions)**

Overview of R language – Defining the R project – Objects and data structures – Graphics using R language – Calculation of measures of central tendency, dispersion, correlation and fitting of regression lines (Linear and logistic).

Overview of Python Language – Regular expressions – Scientific libraries: Numpy, Scipy, Matplotlib and Pandas.

Machine Learning: Supervised learning – Classification (KNN and Naïve Bayes) and Regression (Linear and Logistic) techniques – Unsupervised learning (Clustering methods).

#### **Unit VII: Algebra and Functional Analysis (20 questions)**

**Algebra:** Groups – Subgroups – Normal subgroups – homomorphisms – Isomorphism – Cayley's theorem – Cauchy's theorem – Sylow's theorem – Finite abelian groups – Rings – Euclidean rings – Polynomial rings – Polynomial over the rational field – Polynomials over Commutative rings – Division rings – Frobenius theorem.

Field: Finite fields – Wedderburn's theorem, Extension Fields.

**Functional Analysis:** Fundamentals of normed Linear spaces, bounded Linear maps on Banach spaces, open mapping theorem, Bounded operators of Hilbert spaces.

#### **Unit VIII: Real and Complex Analysis (20 questions)**

Limit, Continuity, types of discontinuities, infinite limits, function of bounded variation, metric spaces. Reimann Integral – Fundamental theorem of calculus – mean value theorem. Reimann Stieltjes Integral.

**Complex Analysis:** Local properties of analytic functions – Removable singularities Taylor's theorem - Zeros and poles, local mapping – maximum principle – Harmonic functions – power series expansions – Weierstrass theorem – Taylor's series, Laurents series.

#### **Unit IX: Differential Equations (20 questions)**

Linear differential equations of higher order – Linear dependence and Wronskian basic theory – solutions in power series – Introduction to second order linear equations with ordinary points. Legendre equations and legender polynomial, Second order equations with regular singular points, Bessel equations. Partial differential equations; first order, Complete Integral, General Integral, Singular Integral, Compatible systems of first order equation, Charpit's method.

#### **Unit X: Differential Geometry (20 questions)**

Curves, analytic representation, arc length, tangent, oscillating plane, Curvature, torsion, formula of Frenet, Contact, natural equations, helices, involutes and evolutes, Elementary theory of surfaces – Analytic representation – first & second fundamental forms, normal – tangent form, developable surfaces, Euler's theorem, Dupin's indicatrices – Conjugate directions, Triply orthogonal system of surface.

### **27. Statistics, Mathematics and Economics (Degree Standard)**

**Code: 504**

#### **Unit I: Algebra and Differential Calculus (20 Questions)**

Theory of Equations: Relations between roots and Coefficients – Complex roots – Irrational roots – Related roots – Transformations of equations – Reciprocal equations.

Matrix Theory: Symmetric – Skew Symmetric – Hermitian – Skew Hermitian – Orthogonal and Unitary Matrices – Rank of a matrix – Consistency and solutions of Linear Equations – Cayley Hamilton Theorem – Eigen values and Eigen Vectors.

Differential Calculus: nth derivative – Leibnitz's theorem and its applications – Partial differentiation – Maxima and Minima of functions of two independent variables.

## **Unit II: Integral Calculus and Differential Equations (20 Questions)**

Integral Calculus: Methods of integration – Properties of definite integrals – Reduction formulae – Double Integrals – triple integrals – Applications to area, surface and volume – simple problems.

First order but of higher degree equations – solvable for  $p$ , solvable for  $x$ , solvable for  $y$  – simple problems.

Second order differential equations with constant coefficients with particular integrals for  $e^{ax}$ ,  $x^m$ ,  $\cos mx$ ,  $\sin mx$ ,  $e^{ax} \cos mx$ ,  $e^{ax} \sin mx$  – simple problems.

Partial Differential equations: Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions – First order P.D.E. – complete integral – Singular integral – general integral – standard types  $f(p,q) = 0$ ,  $f(z,p,q) = 0$ ,  $f(x,y,p,q) = 0$ , Clairaut's form and Lagrange's equations – simple problems.

## **Unit III: Vector Calculus and Operations Research (25 Questions)**

Vector Differentiation: Gradient, divergence, curl, directional derivative, unit normal to a surface.

Vector Integration: line, surface and volume integrals – Applications of Gauss, Stokes and Green's Theorems – simple problems.

Linear programming: Formulation – graphical solution – simplex method – Big-M method – Transportation problem – Assignment problem.

PERT and CPM: project network diagram – Critical path – PERT computations.

Inventory models: Basic concepts – EOQ models (i) Uniform demand rate infinite production rate with no shortages models (ii) Uniform demand rate with finite production rate with no shortages models.

## **Unit IV: Descriptive Statistics and Fitting of Simple equations (20 questions)**

Introduction to Statistics, Uses, scope and limitations - Collection, Classification and Tabulation of data - Diagrammatic and Graphical representations of Data – Measures of location, dispersion, skewness and kurtosis – Bivariate data- Scatter diagram – Correlation, Partial correlation and regression – Fitting of Linear and quadratic equations by the method of least squares.

## **Unit V: Probability and Statistical Inference (25 questions)**

Introduction to Probability - Addition, Multiplication and Baye's Theorems and simple applications. Random variables and Expectation– Univariate Probability distributions – Binomial, Poisson, Geometric, exponential and normal distributions (Mean & Variance). Sampling Techniques – Simple Random Sampling – Stratified and Cluster (Single Stage) - Estimation – Properties, Point Estimation by the method MLE. Tests of Hypothesis – Important terminology – Test procedures for large and small samples ( $z$ ,  $t$ , Chi-square,  $F$ ).

## **Unit VI: Time Series, Index Numbers and Statistical computing using MS-Excel (20 Questions)**

Time series – Components – Determination of Trend (Moving Average, Linear Trend by LSE) - Index Numbers – Construction of Simple, weighted Cost of living index numbers.

Statistical Computing using MS-Excel: Introduction to MS-Excel – MS-Excel Options using Excel Shortcuts – Link the Data in Rows, Columns and Sheet - Functions: Logical Functions -Math and Statistical Functions – Regular Charts-Plotting Density Function and Distribution Function.

## **Unit VII: Micro Economics (15 Questions)**

(a) Definition, Scope and Importance of Micro Economics – Law of Demand – Elasticity of Demand – Utility Analysis – Consumer Surplus.

(b) Production Function – Factors of Production – Producer's Surplus – Economies of scale – Cost and Revenue curves in the Short-run and Long-run – Welfare Criteria – Adam Smith, Bentham, Marshall, Pigou and Kaldor.

## **Unit VIII: Macro Economics (15 Questions)**

Definition, Nature and Scope of Macro Economics – Circular flow of Income in an Open Economy – National Income Accounting – Definition – Concepts: GNP, NNP, GDP, NDP, Personal Income, Per Disposable Income & Personal Savings, Per Capita Income – Keynesian Psychological Law of Consumption – Investment function – Marginal Efficiency of Capital – Multiplier – Accelerator.

Inflation – Deflation – CPI – WPI – Phases of Trade cycle.

**Unit IX: Stabilisation Policies (20 Questions)**

**(a) Monetary Policy:** Barter System – Demand for and supply of money – Functions of money, Functions of Central and Commercial Banks – Money Multiplier – Monetary Policy Instruments – SLR, CRR, OMO & LAF – Functions of Money Market – Capital Market.

**(b) Fiscal Policy:** Taxation – Types of Taxes – Canons of Taxation – Public Expenditure – Causes and Growth – Types of Public Expenditure – Public Debt – Internal and External Public Debt - Budget – Deficit and deficit financing – FRBM (Fiscal Regulation and Budgetary Management) – Fiscal Federalism.

**Unit X: Indian Economy: (20 Questions)**

**(a) Agriculture:** Contribution of the Agriculture sector to National Income and Employment – Agriculture Price Policies – Agriculture Statistics – Modern Technology in Agriculture Statistics – Agriculture Finance and Marketing.

**(b) Industry:** Contribution of the Industrial Sector to National Income and Employment – MSME and Large Scale Industries – Industrial Policy Resolutions – Industrial finance.

**(c) Service Sector:** Contribution of the Services Sector to National Income and Employment –Transport, Communication and IT Sectors.

**(d) Economics of Planning:** Five Year Plans – Planning Commission – Finance Commission – NITI Aayog – Government Welfare and Employment Generation Programmes.

**(e) Population:** Demographic transition and Demographic Statistics – Poverty Alleviation Programmes.

**28. Town Planning, Civil Engineering and Architecture  
(Degree Standard)****Code: 560****Unit I: Introduction to Planning - Theory and Techniques (20 Questions)**

Planning System in India, Regional Plan, Master Plan, Structure Plan, Detailed Development Plans, City Corporate Plan and Smart City Plan - Concept of Region, Types of Region, Techniques of Regional Analysis. Multi-level Planning - Process of evolution of human settlement planning - Simulation models, Gravity analysis, Lowry model, Threshold analysis, Multivariate analysis – Optimization and economic analysis methods in project formulation and implementation.

**Unit II: Urban Sociology, Economics, Geography and Environment - Theories and Applications (20 Questions)**

Ecological processes and structures in Indian Cities - Social Change & Economic Development - Agglomeration economics - Economics of scale, Multiplier effect concept, scope, limitation - Basic and non-basic activities of economics base, methods of base identification - Land-use determinants, Locational Dynamics of urban Land-use - Spatial organization of Urban settlements - City-region, Urban Sprawl and Fringe - Urbanization in India and Tamil Nadu with reference to settlements and population distribution. Environmental Impact Assessment Practice in India - Types, Conceptual Approach and Phases of EIA – Environmental Concepts – Sustainable Planning – Eco Cities, Compact Cities, Smart growth, Sponge city.

**Unit III: Remote Sensing, G.I.S. and Current Trends in Planning (20 Questions)**

Basics of Remote Sensing and GIS. - Classification of spatial and non - spatial data application in planning - spatial data layers - Coding schemes – Digitization of spatial data – Editing spatial data usable for the given planning problem – Land use Suitability Analysis, Land use Modeling, Existing Land use Preparation using Mobiles, Satellite Imageries, Aerial Photographs, Drones in Physical Planning. Emerging Concepts of sustainable urban development, E – Governance, HRIDAY, Rurban Mission, AMRUT, Public private partnership, Local bodies and urban finance. Land Pooling concept, Transfer of Development Right, Accommodation Reservation, Formulation of Re-development and Urban Expansion Plans - Local Area Plans, Town Planning Schemes - Special Economic Zone, Value Capture Finance Policy Framework – Swiss Challenge Model, Industrial Corridor, Coastal Zone Management Plan, Planned Unit Development.

**Unit IV: Physical Infrastructure and Legislation (20 Questions)**

Implication of Urban Form and Size on Services Highway classification - Traffic and Transportation Survey - Para Transit modes – Private transport – Urban Transportation Planning Process – Trip Generation –

Trip Distribution – Modal Split – Trip Assignment, Congestion pricing, Non Motorized Transport, Transit Oriented Development, Bus Rapid Transit System, Unified Transport Authority. Tamil Nadu Urban Local Bodies Act, 1996 and Tamil Nadu Urban Local Bodies Rules, 2023. 73<sup>rd</sup> and 74<sup>th</sup> Constitutional Amendment Act (CAA) and their implications on planning and development. Town and Country Planning Act of Tamil Nadu 1971, Tamil Nadu Combined Development and Building Rules 2019, Urban and Regional Development Plans Formulation and Implementation (URDPFI) and Rural Area Development Plans Formulation and Implementation (RADPFI).

#### **Unit V: Design of Reinforced Concrete, Pre stressed Concrete and Steel Structures (20 Questions)**

Design of concrete members - limit state and working stress design concepts - design of slabs - one way, two way and flat slabs - Design of singly and doubly reinforced sections and flanged sections - design of columns and footings – pre- stressing - systems and methods- post tensioning slabs - Design of pre-stressed members for flexure.

Design of tension and compression members - Design of bolted and welded connections design of members of truss - designs of columns and bases - design of beams, plate girders and gantry girder- design of liquid storage structures –elevated and underground- design of retaining wall.

#### **Unit VI: Environmental Engineering and Pollution Control (20 Questions)**

Sources of water - Water Demand -- Characteristics and analysis of water – hydraulics for conveyance and transmission - water borne diseases – Functional design of water treatment plant – desalination plant- water distribution system – pipe network analysis- characteristics and composition of sewage - Planning and design of sewerage system - sewer appurtenances - Pumping of sewage - sewage treatment and disposal - Design of storm water drain- plumbing system in high rise building - industrial waste treatment - solid waste management – Air and Noise pollution control – E-Waste management.

#### **Unit VII: Urban and Transportation Engineering (20 Questions)**

Urbanization trend and impact - Slum clearance and slum improvement programmes - Different modes of transport and their characteristics. Geometric design of highways. – Pavement materials and testing – alternate pavement materials- modified binders - Design and Construction of bituminous and concrete roads – pavement distress and evaluation - Maintenance of roads – Railways - Components of permanent way - Signalling, Interlocking and train control - drainage in roads and railways. Airport planning - Components of Airport - Site selection – Runways – Planning of terminal buildings Harbours & Ports - Layout of a harbour - Docks - Breakwaters.

#### **Unit VIII: Introduction to Architecture (20 Questions)**

Definition of Architecture - Integration of aesthetics and function. Elements of Architecture – Form, Space, light, colour, etc. Principles of Architecture – Proportion, Scale, balance, rhythm, symmetry, hierarchy, pattern and axis. Understanding of organization of form and space, volumetric study, architectural characteristics & style of buildings with examples. Understanding user circulation and spatial requirement for all types of buildings. Universal design principles and Barrier free environment. Functional aspects of architecture – site, structure, skin, circulation etc. Principles of composition and relationship between human activities and anthropometrics. Modern Architecture - various philosophies, works of postmodern architects. Architecture of India under Colonial rule. Post-independence architecture in India - works of Indian Architects. Contemporary World Architecture & recent trends. Building Rules and Regulations, National Building Code.

#### **Unit IX: Site Planning, Climatic Design and Energy Efficient Architecture ( 20 Questions)**

Site Planning – Introduction to basic terminologies, Methods of surveying, Instruments & Application, Levelling, Site Drawings, Importance of Site Analysis – On-site & off-site factors, Study of micro climate, Site Diagramming, Site Context, Site planning & Site layout principles. Organization of spaces – circulation, built form and open spaces, site planning and micro climate, site planning for neighborhood parks, children's play area and campus development – Landscaping of Functional areas – Urban open spaces and principle of urban landscape – Street landscaping, landscape design for waterfront areas and functional areas in urban centers – green roofs and walls. Climate & Human comfort, Visual and Acoustical comfort in built environment. Solar Control, Heat flow through materials & building envelope design, Air movement patterns through natural & built forms, Design strategies for different climate types. Energy

Efficiency – Importance & Significance, Passive Heating & Cooling techniques, case studies, day Lighting & Natural ventilation, Use of Renewable energy systems – Current & future trends. National and state level government organizations -initiatives, schemes and projects. Relevant National and state level legislations and guidelines.

### **Unit X: Human Settlements Planning and Urban Studies (20 Questions)**

Origin of Human settlements In India & the rest of the world – River valley civilizations (Indus Valley, Mesopotamia, Egyptian & Chinese) – Traditional planning principles in India – approaches & concepts – Classical & Medieval planning in Europe and India - Evolution of modern planning theory, concepts and works of town planners; Contemporary Urban planning – Issues and Trends. Urban Design – need, aspects, scope & components of urban space – Indian Urbanism - Theorising & Reading urban space – Imageability & townscape elements, social aspects of urban space, gender & class. Urban Public spaces – Universal design, pedestrian friendly environment, streetscapes. Conservation in India – Understanding the need & purpose, definition, Adaptive re-use, International agencies & their role – Policies & legislations, case studies – Conservation practice and Planning.

### **29. Translation (Descriptive Type) (Degree Standard)**

**Code: 462**

**Translation of the following from English to Tamil:**

- (a) State Acts, Bills, Ordinances, Rules and Notifications made thereunder. (145 Marks)
- (b) Central Acts, Ordinances, Rules and Notifications made thereunder. (105 Marks)
- (c) Legal Terms / Legal Maxims. (50 Marks)

### **30. Travel and Tourism (Degree Standard)**

**Code: 597**

#### **Unit I: Principles and Practices of Tourism (20 Questions)**

Introduction to Tourism – Meaning and Scope, Concept, Components and types of Tourism - Evolution of Tourism in India and Tamil Nadu – Travel Motivation – Early History, Ancient Civilisation, Travel Through Ages – Emerging Trends – Ministry of Tourism, Government of India – Government of Tamil Nadu, Department of Tourism and Organisation Structure – Tourism Statistics.

#### **Unit II: Tourism Products of India (30 Questions)**

Unique features of Tourism Products – Tourist attractions – Hills, Beaches, Mountains, Flora and Fauna, Major wildlife Sanctuaries and National Parks, Water Bodies, Backwater – Land, Air, Water Based adventure activities.

Forts, Palaces, Museums, Temples, Churches, Mosque and other religious worship Places – UNESCO World Heritage Sites, Tamil Nadu Heritage Sites and Architectural features.

Fairs and Festivals, Folk Dances, Dance, Music, Arts and Crafts – Culinary Tourism – Major Tourist Circuits of India and Tamil Nadu.

#### **Unit III: Transport (20 Questions)**

History and Development – Land – Water and Air – Growth of Road Transport – Indian Road Network – Major Rail Network of India – Types of Rail Tours in India – Water Transport – Cruise Ships – Ferries – Hovercraft – River and Canal Boats – Boat Houses - Air Industry, Airlines in India, Functions, Present policies – Air Charters.

#### **Unit IV: Accommodation Operations (20 Questions)**

Origin and growth of Hotels – Types and Classification of Accommodation, Hotels on the basis of Size, Location, Facilities, Plan, Service and Ownership – Allied Catering Services – Supplementary

Accommodation – House Keeping – Safety Measures – Front Office Management – Booking Procedures – Types of Food and Beverage Outlets and Promotions.

#### **Unit V: Tourism Marketing and Promotions (25 Questions)**

Unique features of Tourism Marketing – Market Segmentation – Marketing mix – Tourists behavior – Distribution channel and its characteristics – Market research – Market forecast – Destination Life Cycle – Marketing Promotions – Tools of Promotion – E-Marketing, Digital Marketing – Domestic and International Travel Marts – Branding of Tourism Products – “Incredible India” Campaign – “Where Stories Never End” Tamil Nadu Campaign – International and National Tourism Day – Swachh Bharat Abhiyan and other Schemes.

#### **Unit VI: Tourism Policy and Planning (15 Questions)**

Need and Objectives of Tourism Policy – John Sargent Committee – L.K.Jha Committee (Adhoc Committee), 1963 - National Tourism Policy, 1982 - Yunus Committee, 1988 – Ancient Monuments Preservation Act, 1904 – Ancient Monuments and Archaeological Site and Remains Act, 1958 – Tourism Finance Corporation of India – National Action Plan on Tourism, 1992 – National Tourism Policy, 2002, 2023 – Tourism in Five Year Plans – Tamil Nadu Tourism Policy, 2023 – Guidelines and regulations – PPP (Public Private Partnership).

#### **Unit VII: Functions of Travel Agency and Tour Operation (20 Questions)**

Setting up of Travel Agency and Registration, Role and Types - Tour Operation Procedures – Tour Package – Itinerary Preparation – Tour Costing – Travel Formalities – Travel Documents, Passport, VISA, Health Regulations, Travel Insurance, Customs Clearance, Foreign Exchange formalities – Baggage Rules.

#### **Unit VIII: Tourism Geography (25 Questions)**

Physical Geography of India – Sub Continent - Climate - River System – Mountains – Plains – Political Geography of India – World Traffic Conference Area, TCA1, TCA2, and TCA3 Three Letter City Codes, Countries, Capitals and Currencies - World Time Zones, GMT – India Time Zone.

#### **Unit IX: Tourism Organisations (15 Questions)**

Organisations and Functions of WTO (World Tourism Organisation), ICAO (International Civil Aviation Organisation), IATA (International Air Transport Association), PATA (Pacific Asia Travel Association), TAAI (Travel Agents Association of India), IH&RA (International Hotel and Restaurant Association), SIHRA (South Indian Hotel and Restaurant Association), FHRAI (Federation of Hotel and Restaurant Association of India), FICCI (Federation of Indian Chamber's of Commerce and Industry), SICCI (South India Chamber of Commerce and Industry), TFCI (Tourism Finance Corporation of India), SEPC (Services Export Promotion Council), IATO (Indian Association of Tour Operators), NTAC (National Tourism Advisory Council), FAITH (Federation of Association in Indian Tourism and Hospitality), ATOAI (Adventure Tour Operators Association of India), RTSOI (Responsible Tourism Society of India) and GTTAA (Global Tourism Travel Agents Association of India).

#### **Unit X: Impact of Tourism (10 Questions)**

Positive and Negative – Socio-Cultural and Economic Impacts – Physical and Environment Impacts - Earth Summits – SDGs (Sustainable Development Goals).

### **31. Visual Communication (Degree Standard)**

**Code: 477**

#### **Unit I: History of Photography (20 Questions)**

Evolution and invention of photography and the camera - Basic principles of photography-Camera parts and its functions- Photography as a medium of Art and Science-Photography in 19<sup>th</sup> and early 20<sup>th</sup> century- Technological innovations - Transition to digital age – Digital evolutions in Photography-Contemporary and future trends.

## **Unit II: Basics of Photography and Techniques (20 Questions)**

**Camera anatomy** – Parts (Lens, Body, Flash Light, View finder). Lens – Normal, Wide, Telephoto, Macro. Depth of Field

Depth of Focus, Mounts: E-mount, A-Mount, PL-mount- Block lenses and Zoom Lenses, Focal length Aberrations.

**Exposure** – Bracketing – Exposure triangle – (Aperture, Shutter,ISO) Over Exposure, Under Exposure – Toe & Shoulder region- Histogram – False colour – TTL meter - HDR.

**Sensors** – Human eye – Pixel – Resolution, Image formation – Electronic shutter, Focal plane shutter.

**Shutter** - Types – Mirrorless – Portrait Wildlife, Sports, Candid.

**Mode**– Portrait, Shutter, Manual, G Mode, Aerial, Mobile, 360° Geo tag Remote Sensing, Infrared.

**Flash** – Types - On-cam flash, High speed sync, TTL, Ring, Umbrella, Wireless – Flash sync.

**Colour Space** – Colour Temperature- RGB, CMYK – Sharpness – Contrast, Brightness- White Balance.

**Light Source**– Indoor, Outdoor, Flash, LED, White Balance.

## **Unit III: Visual Aesthetics (20 Questions)**

Basic concepts of visualisation in Photography - Understanding of Indian and western visual aesthetics- Principles of Composition: Rule of Third, Lead in lines, Diagonal. Framing, Depth of field, Cropping, Aspect ratio etc., - Modern concepts of digital photography- designing Visual communication and photography as a means of expression - understanding of visual practices and contemporary transformations. Angles and Shots.

## **Unit IV: Photo Journalism (20 Questions)**

Objectivity – Truth, Timeliness, News value. Visual appeal - Publicity, Propaganda, Framing, Revelation, Rhetoric, Image manipulation, Distortion, Captioning and content creation. Documentation – Archival, Stock Photography. Eye tracking – Simplification. Limiting focus, de-cluttering. Pictorials – Gendered image, Epitome, Un obtrusiveness, Hyper photography, Proxemics, Copyright, manipulation.

## **Unit V: Camera (20 Questions)**

**Camera** - Types –SLR, TLR, DSLR and Mirrorless –Aspect ratio

**Recording Formats** – Memory Cards (SD, Micro SD, CF card (compact flash) – Speed, Memory, XQD card.

## **Unit VI: Equipments (20 Questions)**

**Filter** – ND, Polarizer, UV, Colour Conversion Effects Filters, Gels, Modifiers – Gobos, Patterns.

**Tripods** – Monopods – Gorilla Stand – Rings. Reflectors – Diffusers

**Lights** – Flash light, Umbrella Light, Wireless Light, Natural Lights,

**Batteries & Power supply** – Battery grips – External Battery packs, Cables.

## **Unit VII: Lighting Techniques (20 Questions)**

**Lighting** - Types – Natural and Artificial – (Sunlight, flash, LED...) – Visible spectrum – Wavelength - Hard light – Soft light, Portrait, Sports, Product (Table – Top), Candid, Flash Photography – Event – Hard Light – Soft Light – Diffuser – Back Light – Types of: Ambient, Fluorescence, Reflector, soft box– Rembrandt – Chiaroscuro, Noton, Butterfly, Split, Rim, Flat.

**Colour temperature**– Kelvin – 3 Point lighting Contrast, ratio (High key, low key)

**Colours** – Tint, shades, Tone – Saturation, Brightness, Primary & secondary (RGB & CMYK) colours – White Balance, Black Balance.

## **Unit VIII: Post – Processing and Editing (20 Questions)**

**Introduction to Adobe Photoshop** - Software interface and cutting tool, Repair and retouching (crop tool, frame tool, Eye dropper tool, Healing brush, clone stamp tool, Erase tool, Dodge tool, pen tool, layers, blending modes) , File formats RAW and JPEG .

Adobe light room : Software interface, tagging photos, processing, creating preset, exporting pictures, colour management, Resolution and pixels for printing image, cropping, resizing Noise Reduction, HDR Dynamic Range, Curve adjustment, panoramas and composites, Raw processing.

**STORAGE:** RAM, Graphics processing, Raid storage, Memory cards, External hard drive, USB flash drive, Solid

State Drive (SSD), Hard Disk Drive (HDD), SD, Micro SD card, Cloud backup, Metadata, Keywords and Tags.

**Unit IX: Social Media: (20 Questions)**

Highlight industry events and exhibitions -incorporate visual storytelling - through captions / end notes engage with interactive posts, Plan and automate posts, Visibility and exposure, networking and community building feedback, Copyright and unauthorized use protecting your work, Algorithmic challenge, Instagram, fumble, Behance Pinterest, Facebook, You tube, flickr.

**Unit X: Professional Practices: (20 Questions)**

Building a photography profile - Copyright Act(1957) - copyright infringement - Social Media usage - Unauthorized sharing - Misuse of reposting - infringement -Protecting the ownership; Water marking, Reverse image search - Fair use policy - Popular photo agencies: AP, Getty images, Magnum, istock etc. - Business of photography.

## **Annexure IV**

### **Instructions to be followed by the candidates**

#### **1. Written Examination**

##### **1.1. Reporting Time at the Examination Venue**

1.1.1. To facilitate verification of the identity of the candidates and explanation of the procedures related to the examination, the candidates shall present themselves at the examination venue one hour before the time scheduled for the commencement of the examination.

1.1.2. All gates serving as entry into the examination venue shall be closed thirty minutes before the commencement of the examination. After that, no candidate shall be permitted to enter the premises of the examination venue.

1.1.3. In case of examinations to be held in both forenoon and afternoon sessions, the reporting time for the afternoon session shall also be thirty minutes before the commencement of the examination and no one shall be allowed into the venue thereafter.

##### **1.2. Entry into the Examination Venue**

1.2.1. Candidates shall present themselves at the examination venue with the memorandum of admission (hall ticket) downloaded from the Commission's website, failing which, they shall not be allowed to write the examination. Candidates shall also bring with them, a photocopy of their Aadhaar card / Passport / Driving Licence / Permanent Account Number (PAN) card / Voter ID card as identity proof.

1.2.2. Candidates must appear for the examination at the venue they have been allotted, as mentioned in the memorandum of admission (hall ticket). Change of venue will not be permitted. No candidate, without prior approval, shall be allowed to appear for the examination at a venue other than the one originally allotted.

1.2.3. Candidates may be subjected to frisking at the examination venue, if required, with the assistance of male/female police personnel or any authorized persons, as the case may be.

1.2.4. Parents and others who accompany the candidates will not be permitted inside the examination venue.

##### **1.3. Memorandum of Admission (Hall Ticket)**

1.3.1. If the photograph of the candidate in the memorandum of admission is not printed or not clear or does not match with candidate's appearance, he/she should furnish a separate photograph affixed on a plain paper, along with his name, address, register number and signature along with a copy of the memorandum of admission (hall ticket) and a copy of Aadhaar card / Passport / Driving Licence / Permanent Account Number (PAN) card / Voter ID card, to the Chief Invigilator, who shall countersign it. The identity proof in original, should also be shown to the room invigilator for verification. The room invigilator upon verification of the identity of the candidate, shall obtain an undertaking as to the genuineness of the candidate and to the effect that he/she is aware that he/she is liable to any criminal/penal action initiated by the Commission, if the information furnished is found to be incorrect at a later date. The undertaking shall then be handed over to the Chief Invigilator.

1.3.2. Candidates must show the memorandum of admission to the Invigilator / Chief Invigilator / inspection authorities / any authorized persons of the examination hall, on demand for verification.

1.3.3. The memorandum of admission should be preserved carefully and retained permanently. The memorandum of admission should be produced if shortlisted for the next stage of selection / whenever sought by the Commission. The memorandum of admission may also be photocopied, as a precaution, after the examination is over. No duplicate memorandum of admission will be issued later.

## 1.4. Examination Room

1.4.1. The candidates shall compulsorily be seated in the examination room thirty minutes before the time scheduled for the commencement of the examination.

1.4.2. Candidate must sit in the place allotted after checking the name, register number and photo as pasted on the table

1.4.3. Water, tea, coffee, snacks, soft drinks, etc., will not be allowed inside the examination room.

1.4.4. Candidates should maintain strict discipline not only in the examination room but also inside the campus of the examination venue. Candidates found smoking / intoxicated or found to have entered into a quarrel of any kind, or to have misbehaved with the Chief Invigilator or with the inspection authorities or with the invigilator or with any other candidate either in the examination hall or inside the campus of the examination venue, either before, during or after the examination, are liable to invalidation of answer sheet and debarment for any period the Commission may deem fit, as well as appropriate criminal action.

1.4.5. Candidates suffering from serious health issues, may, with the consent of the Chief Invigilator, deposit medication or other medical requirements on the room invigilator's table for use if needed.

1.4.6. In case of extraordinary circumstances, like pandemic conditions, etc., the procedures / precautions prescribed (e.g., use of sanitizer and face mask, practicing social distancing) shall be adhered to.

## 1.5. Alarm Bell

An alarm bell shall be sounded in respect of each of the following activities to alert the candidates. The room invigilators shall make appropriate announcements as and when required.

Event	Timeline	Duration of Bell
<b>Before Commencement of Examination</b>		
<b>Objective type Examination:</b> i. Distribution of OMR Answer Sheet	30 minutes before	Short Bell (2 seconds)
ii. Distribution of Question booklet	15 minutes before	Short Bell (2 seconds)
<b>Descriptive type Examination:</b> Distribution of Question-cum-Answer Booklets	15 minutes before	Short Bell (2 seconds)
<b>At the Start and During the Examination</b>		
Commencement of the Examination	At the Designated Time	Long Bell (5 seconds)
During the Examination	Every One Hour	Short Bell (2 seconds)
Before Conclusion of the Examination	10 minutes before conclusion	Short Bell (2 seconds)
<b>At the Conclusion of the Examination</b>		
Conclusion of the Examination	At the Designated Time	Long Bell (5 seconds)

## 1.6. Instructions for the Objective Type Examination (OMR)

1.6.1. Candidates must carry only black ink ball point pen, a photocopy of any one proof of ID, as specified and memorandum of admission (hall ticket) inside the examination room. Other materials are not allowed.

## 1.6.2. OMR Answer Sheet

1.6.2.1. The pre-printed personalized OMR answer sheets containing photograph, name, register number, subject, examination centre and venue, date and session as mentioned in the memorandum of admission (hall ticket) will be distributed thirty minutes before the time scheduled for the commencement of the objective type examination.

1.6.2.2. Before using the OMR answer sheet, the photograph and the details printed on it shall be verified by the candidates. It shall be ensured that the OMR answer sheet pertains to the candidate only. If any of the details are found to be incorrect or defective in any way, it should be immediately reported to the room invigilator for replacement. No OMR answer sheet will be replaced after use.

1.6.2.3. Candidates shall darken all relevant fields of the OMR answer sheet, including the particulars required as well as answers, as per the correct method specified in page 2 of the OMR answer sheet.

சரியான முறை / CORRECT METHOD	தவறான முறை / WRONG METHOD (மதிப்பெண் வழங்கப்படாது) (No mark will be awarded)
1. ● B C D E	1. ● B C D E 2. ● A ● B C D E 3. ● A ● B ● C D E 4. ● A ● B ● C ● D E 5. ● A ● B ● C ● D E 6. ● A ● B ● C ● D E

1.6.2.4. The candidate must write and darken the Question Booklet Number which is used by him / her correctly in the bubbles provided in the OMR answer sheet. The question booklet number darkened by the candidate is final. The OMR answer sheets will be evaluated based on the Question Booklet Number darkened by the candidates in the bubbles. The correct method of darkening Question Booklet Number is illustrated below. For example, if the Question Booklet Number is 1234.

(IV) வினாத்தாள் தொகுப்பு எண் / QUESTION BOOKLET NUMBER:  
தற்காலக் கருவியாகப் பயன்படுத்தப்படும் வினாத்தாளில் அச்சிடப்பட்டுள்ள வினாத்தாள் தொகுப்பு எண்ணின் இழைகள் வட்டங்களில் கருமை நிற கருவியைப் பயன்படுத்தி சரியாக எழுதி அதன் இழை உள்ள சரியான வட்டத்தைக் கருமைப்படுத்தவும்.  
Write the Question Booklet Number printed in the Question Booklet supplied to you in the boxes given below and darken the corresponding bubbles with Black Ink ball point Pen only.

1	2	3	4
●	○	○	○
○	●	○	○
○	○	●	○
○	○	○	●

கருவியைக் கருமைப்படுத்தி வினாத்தாள் தொகுப்பு எண் இழைகளை சரியாக கருமைப்படுத்தவில்லை, OMR வினாத்தாள் செல்லாது எனக் கருதப்படும்.  
The Question Booklet Number darkened by the candidate is final. If not correctly darkened, the OMR answer sheet will be INVALIDATED.

1.6.2.5. Candidates must darken only one of the answer bubbles in the OMR answer sheet, for each question. In case more than one bubble is darkened for a particular question, that answer shall not be evaluated.

1.6.2.6. No answer bubble should be left blank in the OMR Answer Sheet. Option [E] should be darkened if the answer is not known to the candidate. If the candidates darkened the respective answer bubble for all 200 questions, they should darken the circle "Yes". If not darkened the respective answer bubble for one or more questions i.e., left blank, they should darken the circle "No". The candidates should write the total number of questions not darkened at the box provided in Part-I(IV) as below;

(IV) 200 வினாக்களுக்கும் அது தொடர்பான விடைக்குரிய வட்டத்தை கருமையாக்கி விட்டீர்களா?  
Have you darkened the respective answer bubble for all 200 questions?

ஆம் / Yes	இல்லை / No
○	○

இல்லை எனில், கருமையாக்கப்படாத வினாக்களின் மொத்த எண்ணிக்கையை எழுதவும்.  
If 'No', write the total Number of Questions not darkened

1.6.2.7. Candidates shall affix their signature at the designated place in the OMR answer sheet.

**(II) தேர்வரின் உறுதிமொழி / Declaration of the Candidate:**  
 OMR விடைத்தாளின் பக்கம் -2ல் உள்ள அறிவுரைகளை படித்து அறிந்து கொண்டேன். மேலும், OMR விடைத்தாளில் உள்ள அனைத்து விவரங்களும் கருமையாக்கப்பட்டவினாதான் தொகுப்புடன் உட்பட என்னைச் சரிபார்க்கப்பட்டது.  
 I have read and understood the instructions at Page-2 of this OMR answer sheet. Further, all the contents in this OMR answer sheet (including Question Booklet Number darkened) are verified by me.

[Signature Line]

**தேர்வரின் கையொப்பம்**  
**SIGNATURE OF THE CANDIDATE**

(தேர்வர் கையொப்பமிடவில்லைபெனில், விடைத்தாள் செல்லாததாகப்படும்.)  
 (Answer sheet will be invalidated, if Not Signed by the Candidate)

1.6.2.8. Candidates shall affix his / her left hand thumb impression at the designated place in the OMR answer sheet, after the examination is over.

இடது கை பெருவிரல் ரேகை பதியவில்லையெனில் தேர்வர் பெறும் மொத்த மதிப்பெண்களிலிருந்து 0.5 மதிப்பெண் குறைக்கப்படும்.  
**0.5 mark will be deducted** from total marks obtained by the candidate for not affixing Left Hand Thumb Impression.

**(V) தேர்வரின் இடதுகை பெருவிரல் ரேகை மட்டும்.**  
**Candidate's Left Hand Thumb Impression only.**

[Thumb Impression Line]

1.6.2.9. The room invigilator should darken the respective bubble in Column IA with black ink ball point pen, for the following details;

<b>( I A ) TO BE DARKENED BY THE INVIGILATOR (with Black ink Ballpoint pen)</b>		
<b>(a) Candidate's signature available in the space provided</b>	YES <input type="radio"/>	NO <input type="radio"/>
<b>(b) Candidate's Left Hand Thumb Impression available in the space provided</b>	YES <input type="radio"/>	NO <input type="radio"/>

### 1.6.3. Question Booklet

1.6.3.1. The question booklet will be distributed fifteen minutes before the time scheduled for the commencement of the examination.

1.6.3.2. Before writing and darkening the Question Booklet Number in the OMR answer sheet, the candidate shall verify whether all the questions are printed without any omission. In case any defect is found, it shall immediately be reported to the Room Invigilator and a replacement shall be obtained which is complete in all aspects. If any defect is noticed in the question booklet after the commencement of the examination, it will not be replaced.

1.6.3.3. Candidates must not tick mark / mark the answers in the question booklet. Failure to comply with this instruction will result in rejection of candidature.

**1.6.4. Attendance Sheet:** After checking the OMR answer sheet and the question booklet for discrepancies, candidates must sign in the attendance sheet, after verifying his / her name and register number therein, duly mentioning the question booklet number.

1.6.5. The video regarding the instructions to candidates appearing for the objective type examination is available in <https://tnpsc.gov.in/English/omr-guidelines.html> .

## **1.7. Computer Based Test (CBT) Examination**

1.7.1. The Registration for the examination shall start one hour before the time scheduled for the commencement of the examination.

1.7.2. Each candidate will be assigned a Computer to take up the examination.

1.7.3. No computer knowledge is required to take up the Computer Based Test. Knowledge in Mouse operation would suffice to take up the Computer Based Test.

1.7.4. Candidates will be provided with a user name and password to login the system.

1.7.5. Use the keyboard only to key-in the Register Number, User id (registration id) and password.

1.7.6. Necessary instructions will be displayed on the screen. Kindly read all the instructions carefully and follow the instructions without fail.

1.7.7. Questions with five options each will be displayed in the computer screen.

1.7.8. One question will be displayed on the screen at a time.

1.7.9. The questions will appear on the screen in ascending order, which can be answered one by one.

1.7.10. Candidate can use only the mouse to select the correct answers and proceed with answering the questions.

1.7.11. To select your answer of a question, click on the button of one of the options.

1.7.12. Click on Save and Next button after answering every question to save your answer. Otherwise your answer will not be saved.

1.7.13. To deselect your chosen answer, click on the button of the chosen option again or click on the Clear Response button.

1.7.14. Candidates can proceed to the next question by clicking next button or previous question by clicking previous button.

1.7.15. Candidates can recheck his / her answers and if he / she feels to correct the answers, it can be done at any time before the closure of examination. They can skip the questions also, if they desire so.

1.7.16. Candidate can submit their answers at any time during the examination.

1.7.17. Once the entire answers are submitted, the candidates have no option to proceed further.

1.7.18. If the candidates fail to submit their answers, the system will automatically submit the answers to the server, at the closure of the examination.

1.7.19. The question and answers can be zoomed to the required level for the candidates with visual impairment.



1.7.20. Instruction for enlarging images, to view the image provided in the question in a bigger size, click on the image and rotate the scrolling wheel on the mouse.

1.7.21. Question Number Box: Question Number Box displayed on the right side of the screen will show the status of each question using one of the following symbols:

- 1 You have not visited the question yet.
- 2 You have not answered the question.
- 3 You have answered the question.
- 4 You have NOT answered the question, but have marked the question for review.
- 5 You have answered the question and marked for review. This will be considered for evaluation.

The 'Marked for Review' status for a question simply indicates that you would like to look at that question again.

You can click on the ">" arrow which appears to the left of question number box to minimize the question number box. This will enable you to view the question on a bigger area of the screen. To view the question number box again, you can click on "<" arrow which appears on the right side of the screen.

You can click on  to navigate to the bottom and  to navigate to the top of the question area, without scrolling. The summary of number of questions answered, not answered, not visited, marked for review and answered and marked for review will be displayed above the question number box.

1.7.22. Time available for the candidate to complete the examination will be displayed through a countdown timer in the top right-hand corner of the screen. It will display the remaining time as Time Left. (For example: if duration of examination is 3 hours, at the beginning of exam, timer will show 180 minutes and for Differently Abled candidates with scribe / without scribe 240 minutes, which will reduce gradually with passage of time). When the timer reaches zero, the examination will end by itself and the examination will be submitted by the system automatically.

1.7.23. Candidates will be provided with a paper for doing rough work. After closure of the examination, rough sheet will be collected.

1.7.24. Candidates have to sign the attendance sheet and affix thumb impression for verification of his / her identity.

1.7.25. The Examination Hall will be under camera surveillance.

1.7.26. Any attempt of malpractice found, will render you liable to such penal action as the Commission may decide.

1.7.27. In case of doubt in the questions and answers, English version is the final.

1.7.28. To acquaint with the operation of Mouse and the CBT, the candidates can take up the mock test available in the Commission's website ([www.tnpsc.gov.in](http://www.tnpsc.gov.in)) and they can practice the usage of mouse in the mock test. Mock test is similar to the CBT to be held on the day of examination. In the Mock test, all the steps are given similar to the CBT. Candidates can practice the mock test as many times as he / she likes.

## 1.8. Instructions for the Descriptive Type Examination

1.8.1. Candidates must carry only black ink pen (Fountain pen or Ball point pen or Gel pen), a photocopy of any one proof of ID, as specified and memorandum of admission (hall ticket) inside the examination room. Other materials are not allowed.

1.8.2. The question-cum-answer booklet as well as instructions regarding filling up of the same, shall be given fifteen minutes before the time scheduled for the commencement of the examination.

1.8.3. Candidates shall write answers in the question-cum-answer booklet.

1.8.4. Candidates must sign in the attendance sheet, after verifying his/her name and register number therein, duly mentioning the question-cum-answer booklet number.

1.8.5. In cases where the question number and the answer written therein or the question and answer written therein do not correspond to each other or the candidate makes any modification in the question number, such an answer shall not be evaluated.

1.8.6. If an answer booklet of a candidate for one paper is declared deemed not fit for valuation, the answer booklets of the candidate for the remaining papers will also be treated as invalid / not subjected for evaluation.

1.8.7. In case of doubt in the questions, English version is the final.

1.8.8. Borrowing of any material, instruments from other candidates is strictly prohibited. Candidates shall use only their own pens and specifically permitted material.

1.8.9. Candidates shall not be allowed to exceed the time allotted for answering the paper, for any reason.

1.8.10. Candidates should appear for all the papers in the examination for his / her answers to be evaluated and in case the candidate absents himself / herself for any of the papers, the papers attended will not be evaluated.

## **1.9. Other Instructions for the Written Examination**

1.9.1. No candidate will be allowed to leave the examination hall until the closure of the examination.

1.9.2. During the course of Examination, candidates should cooperate with the videographer while capturing the visuals of their face along with their register number written/pasted on the table. If the register number written/pasted on the table is not clearly visible, the candidates should show their memorandum of admission (hall ticket) so that the register number printed on the memorandum of admission is also captured simultaneously.

1.9.3. Requests from candidates for furnishing answer paper copy before the completion of the entire selection process, will not be entertained by the Commission.

1.9.4. After conclusion of the entire selection process, copies of OMR answer sheet / descriptive type answer booklet shall be made available to the candidates on the Commission's website. On requisite payment, the candidates can download the answer papers.

## **1.10. Instructions for Usage of scribe and Compensatory Time**

### **1.10.1. Candidates with Disability**

1.10.1.1. Candidates with disability, shall be permitted to utilize the services of a scribe upon making such request in the online application subject to the following conditions. Request for scribe made after the submission of application or on the date of examination will receive no attention.

1.10.1.2. For the candidate with disability as defined under section 2(s) of the Rights of Persons with Disability Act, 2016, the facility of scribe and/or compensatory time shall be granted solely to those having difficulty in writing subject to uploading of a certificate to the effect that person concerned has limitation to write, including that of speed and that scribe is essential to write examination on his/her behalf from the Medical Board as per the format available in Annexure II . Compensatory time of not less than 20 minutes per hour of examination will be allowed to candidates with disability, who have physical limitation to write including that of speed and who are utilizing the services of a scribe. The candidate with disability should

upload the Certificate of Disability in the format prescribed in Annexure II and the Certificate from the Medical Board in the format available in Annexure V at the time of submission of online application.

### **1.10.2. Candidates with Benchmark Disability**

1.10.2.1. Candidates with benchmark disability, shall be permitted to utilize the services of a scribe / compensatory time upon making such request in the online application subject to the following conditions. Request for scribe / compensatory time made after the submission of application or on the date of examination will receive no attention.

1.10.2.2. Candidate with benchmark disability as defined under section 2(r) of the Rights of Persons with Disability Act, 2016, in the category of blindness, locomotor disability (both arm affected) and cerebral palsy, the facility of scribe shall be given, if so desired by the candidate. Compensatory time of not less than 20 minutes per hour of examination will be allowed to candidates with blindness, locomotor disability (both arm affected) and cerebral palsy and who are utilizing the services of a scribe. The candidates with benchmark disability in the category of blindness, locomotor disability (both arm affected) and cerebral palsy should upload the Certificate of Disability in the format prescribed in Annexure II, at the time of submission of online application.

1.10.2.3. In case of other category of benchmark disability, the provision of scribe can be allowed on uploading of a certificate from the Chief Medical Officer / Civil Surgeon / Medical Superintendent of a Government Health care institution, to the effect that person concerned has limitation to write, including that of speed and that scribe is essential to write examination on his/her behalf. Compensatory time of not less than 20 minutes per hour of examination will be allowed to candidates with other category of benchmark disability and who are utilizing the services of a scribe. The format of the certificate is available in Annexure II. The candidates with other category of benchmark disability should upload the Certificate of Disability in the format prescribed in Annexure II and the Certificate from the Chief Medical Officer / Civil Surgeon / Medical Superintendent of a Government Health care institution in the format available in the Annexure V, at the time of submission of online application.

1.10.2.4. All candidates with benchmark disability who have physical limitation with regard to writing including that of speed and not availing the services of a scribe will be allowed additional time of a minimum of one hour for an examination of three hours duration, on production of a certificate from the Chief Medical Officer / Civil Surgeon / Medical Superintendent of a Government Health care institution, to the effect that person concerned has limitation to write and compensatory time is recommended. Such candidates with benchmark disability should upload the Certificate of Disability in the format prescribed in Annexure II and the Certificate from the Chief Medical Officer / Civil Surgeon / Medical Superintendent of a Government Health care institution in the format available in Annexure V at the time of submission of online application.

1.10.3. Failure to upload the certificates as mentioned above at the time of submission of online application shall result in rejection of claim after due process.

1.10.4. The Commission will arrange for scribes and the fee amount to be paid to the scribes will be met by the Commission. Candidates availing of the services of the scribes need not pay any fee to them.

1.10.5. All candidates with disability, availing of the services of the scribes while appearing for the written examination will be seated in a separate room in the ground floor, in close vicinity to the Chief Invigilator's control room and under the close supervision of the Chief Invigilator.

### **1.11. Special Instructions for the Candidates with Benchmark Disabilities**

1.11.1. Candidates with benchmark disability must affix their signature and left hand thumb impression in the space provided in the answer sheets, if possible. Candidates with locomotor disability and visual impairment who have been permitted to use scribe facility, who are unable to affix their signature, may affix their left hand thumb impression alone. Candidates who are unable to use their left hand, must affix right hand thumb impression. Candidates who are unable to use both hands, and who have been permitted to use scribe, may leave the signature and thumb impression columns blank.

1.11.2. All persons with benchmark disability, who are unable to climb the staircase, will be allowed to write the examination in a room in the ground floor, in close vicinity to the Chief Invigilator's control room.

## **1.12. Penalty for Violation of Commission's Instructions**

The answer sheets of the candidate will be invalidated / marks deducted / criminal action initiated / and debarment imposed for the following violations:

### **1.12.1. Invalidation of Answer Sheet in Objective Type Examination**

1.12.1.1. Usage of pen other than black ink ball point pen.

1.12.1.2. Usage of pencil.

1.12.1.3. Making any irrelevant or impertinent remarks / symbols.

1.12.1.4. If the Barcode / OMR-track printed on page 1 of the OMR answer sheet is tampered with.

1.12.1.5. If the candidate has not signed in the space provided in page 1 at part II OMR answer sheet.

1.12.1.6. Required particulars in the OMR answer sheet have not been filled up.

1.12.1.7. Wrongly seated in the place of other candidates and/or written the examination using the OMR answer sheet of other candidates.

1.12.1.8. If the bubbles for Question Booklet Number are not shaded

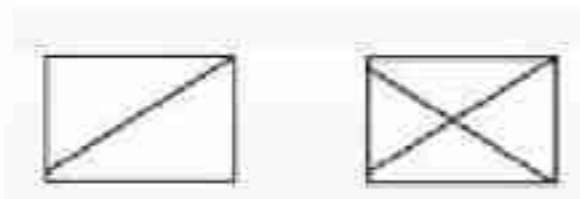
1.12.1.9. If the Question Booklet Number printed in the Question Booklet supplied to the candidate is not darkened correctly in part II (I) of OMR answer Sheet / or even if one or more bubble(s) of Question Booklet Number is left blank (not darkened) in the OMR answer sheet.

1.12.1.10. Candidates must darken only one of the answer bubbles in the OMR answer sheet, for each question. In case more than one bubble is darkened for a particular question, that answer shall not be evaluated.

1.12.1.11. Question Booklet Number darkened in bubbles provided for Question Booklet Number by the candidate is out of question booklet number series printed [Not in range of QB series.

1.12.1.12. If either Part-I or Part-II or both of OMR Answer Sheet is crossed out.

For Example:



### **1.12.2. Invalidation of Answer Booklet in Descriptive Type Examination**

1.12.2.1. Usage of pens other than black ink pens. The candidate shall use the same black ink pen (Fountain pen or Ball point pen or Gel pen) in the entire answer booklet for all purposes including writing the register number, signing on the first page, answering, drawing, underlining, highlighting, striking off unused space in the answer booklet, striking off answers in excess of the number required, etc. For this purpose, candidates should keep sufficient number of additional black ink pens of same type, with same colour and shade of ink.

1.12.2.2. Usage of whitener, sketch pens, pencil, colour pencils, multicolour pens, crayons or any other writing materials, for any purpose.

1.12.2.3. Writing religious symbols, writing their name, signature, phone number, cell phone number, initials, address and writing any other name, initial or address in the answer booklet except in the manner instructed in the question-cum-answer booklet.

1.12.2.4. Appealing to the examiner in the answer booklet, invoking sympathy of examiners in connection with their results.

1.12.2.5. Candidates writing anything unconnected to the question, or any impertinent remarks and irrelevant matter revealing his / her identity.

1.12.2.6. Writing the answers in more than one language (i.e., partly in Tamil and partly in English) except in cases where specifically permitted. If the candidates answer in Tamil, they should write the entire examination in Tamil only or if the candidates answer in English, they should write the entire examination in English only. However, technical words which cannot be translated, can be written in the respective languages, i.e., only the technical words and not the entire sentence / entire answers. The answer booklet of the candidate who violates this instruction will be invalidated.

1.12.2.7. Wrongly seated in the place of other candidates and/or written the examination using the answer booklet of other candidates.

1.12.2.8. Tampering with the Barcode printed on the question-cum-answer booklet.

1.12.2.9. The question-cum-answer booklet has not been signed by the candidates in the designated places.

### **1.12.3. Deduction of Marks for Objective Type Examination**

1.12.3.1. In case of non-personalised OMR answer sheet, two marks will be deducted for writing the register number incorrectly.

1.12.3.2. If none of the respective answer bubble is darkened for any of the question, (i.e., if left blank) 0.5 mark will be deducted from the total marks obtained by the candidate.

1.12.3.3. If Left Hand Thumb Impression is not affixed at the space provided at part 1 of page 1 of the OMR answer sheet, 0.5 mark will be deducted from the total marks obtained by the candidate

**1.12.4. Criminal Action:** Criminal action will be initiated against the candidates for the following reasons.

1.12.4.1. Misbehaviour and indiscipline in the examination hall: Candidates should maintain strict discipline not only in the examination room, but also inside the campus of the examination venue. Candidates found smoking / intoxicated, or found to have entered into a quarrel of any kind, or to have misbehaved with the Chief Invigilator or with the inspection authorities or with the invigilator or with any other candidate either in the examination hall or inside the campus of the examination venue, either before, during or after the examination, are liable to invalidation of Answer sheet and debarment for any period the Commission may deem fit, as well as appropriate criminal action.

1.12.4.2. Indulging in any type of malpractice, including impersonation and resorting to unfair means within the examination hall or outside will lead to debarment for any period deemed fit by the Commission, besides initiation of criminal action.

1.12.4.3. Invalidation of Answer sheet / Question-Cum-Answer Booklet as well as debarment for such period as the Commission may deem fit will be imposed on candidates resorting to any kind of irregularity or malpractice within / outside the examination hall including:

- a. Consulting with / copying from another candidate in the examination hall.
- b. Permitting others to copy from his/her Answer Sheet / Question-cum-Answer Booklet
- c. Copying from books or notes which are printed / typewritten / handwritten.

- d. Seeking the help / assistance of any official / hall supervisor in answering questions in examination hall.
- e. Approaching or attempting to approach an examiner or getting other people to approach an examiner on his behalf.
- f. Possession of electronic devices such as cellular phones, watches with inbuilt memory note, and rings with in-built memory notes, Bluetooth devices, communication chip, other electronic devices and non-electronic devices such as P&G design data book, books, notes, handbags, other non-permitted materials, etc.
- g. Taking away from the examination hall, the whole or part of any used / unused Answer Sheet / Question-cum-Answer Booklet without handing it over to the room invigilator.
- h. Tampering with the Barcode / OMR Track printed on the Answer Sheet / Question-cum-Answer Booklet.

1.12.4.4. Violation of any one or more of the instructions contained in the Commission's Instructions to Applicants, instructions mentioned in the Notification, instructions printed on the memorandum of admission (hall ticket) shall also make the candidate liable to debarment, either permanently or for such period as the Commission deems fit, and/or rejection of candidature after due process and /or any other penalty, as decided by the Commission.

### 1.12.5. Debarment

The period for which candidates shall be debarred from appearing for the examinations / participating in the recruitment processes conducted by the Commission, for the offences committed by the candidates are given below. Besides debarment, the candidate shall also be liable to rejection of candidature after due process, invalidation of answer sheet, as the case may be. Criminal action may also be initiated against such candidates wherever indicated.

S. No	Nature of Offence	Period of Debarment
1	Attempts to influence the Chairman, Members of the Commission, Secretary, Controller of Examinations or any officer or staff of the Commission, personally / by letter / through relatives, friends, patrons, officials or other persons.	Three Years
2	Production of bogus community / destitute widow / differently abled / ex-serviceman / transgender / person studied in Tamil medium certificates, etc. Tampering or alteration in the documents or certificates.	Permanent, Initiation of criminal action
3	Suppression of material information, at any stage of the selection process, regarding: (i) Previous appearances or availing free chances. (ii) Regular / temporary employment in other Recruiting Agencies or Authorities of in the state or Union Government or other States or Union Territories or National Capital Territory or Public Sector Undertakings or Universities or Cooperative Societies or Local Bodies or Quasi Government Organizations either State or Central. (iii) Criminal cases except the cases filed below the age of 18 (Juvenile) irrespective of the outcome of cases, arrests, convictions, disciplinary proceedings etc., (iv) Debarment or disqualification by Union Public Service Commission / State Public Service Commissions / other agencies	One Year
4	Possession of electronic devices such as cellular phones, watches with in-built memory notes and rings with in-built memory notes, Bluetooth devices, communication chip, any other electronic devices inside the examination room and also seeking the help of / assistance of any official / invigilator / any outsider in answering question	Permanent

5	Possession of non-electronic devices such as P&G Design Data Book, books, notes, guides, handbags, other non-permitted materials, etc. inside the examination room.	Three Years
6	Consulting with other candidates, copying from other candidates, permitting others to copy from his / her answer paper, copying from books or notes which are printed / typewritten / hand written, etc.	Three Years
7	In addition to the offences listed herein, the involvement of candidates in any indiscipline or irregular practices within / outside the examination room.	Three Years
8	Written certain unwarranted remarks unconnected with answers to the subject concerned in the answer books, etc., i.e., vulgar, derogatory and obscene language.	Three Years
9	Appeal to the examiners in the answer books, to value liberally or to award more marks or to be sympathetic, etc.	One Year
10	Approaching or attempting to approach an examiner or getting other people to approach an examiner on his / her behalf	Permanent, Initiation of criminal action
11	Taking away from the examination hall, the whole or part of any used / unused question-cum-answer booklet, without handing it over to the room invigilator. Tampering with the Barcode.	Three Years
12	Candidates found smoking / intoxicated, or found to have entered into a quarrel of any kind, or to have misbehaved with the Chief Invigilator or with the inspection authorities or with the invigilator or with any other candidate either in the examination hall or inside the campus of the examination venue, either before, during or after the examination.	Three Years
13	Indulging in grave malpractices, including impersonation, amounting to subversion of the conduct of examination.	Permanent, Initiation of criminal action

## 2. Answer Key Challenge for Objective Type Examination

2.1. Tentative answer keys will be hosted in the Commission's website within twenty six working days from the date of conduct of examination. Instructions available in the Para 17 D (iv) of Instructions to Applicants are not applicable to this recruitment. Candidates can challenge the tentative answer keys through the 'Answer Key Challenge' window available in the Commission's website ([www.tnpsc.gov.in](http://www.tnpsc.gov.in)) [Recruitment → Answer Keys]. Representations, if any, challenging the tentative answer keys shall be submitted only through online mode within seven days from the date of publication of tentative answer keys. Representations received by post or e-mail will receive no attention.

2.2. Detailed instructions, procedures to challenge the tentative answer keys have been made available in the Commission's website. Representations made online/offline after the closure of the window will also receive no attention.

2.3. The challenges submitted on time, through the online mode, shall be referred to a committee comprising of experts in each subject. The decision on the final answer key shall be made, based on the recommendations of the expert committee and answer sheet evaluation shall commence thereafter.

## 3. Onscreen Certificate Verification

3.1. Onscreen Certificate Verification will be done based on the documents already uploaded by the candidate at the time of online application.

3.2. Based on the onscreen certificate verification, the candidates will be given 10 calendar days to upload the required document(s) / defective document(s) or certificate(s). Failure to re-upload the required document(s) / defective document(s) or certificate(s) as per the claim in the online application within the time stipulated by the Commission, shall result in rejection of claim.

#### **4. Physical Certificate Verification**

4.1. Candidates admitted to physical certificate verification shall produce all the original certificates uploaded / re-uploaded (if applicable) for physical certificate verification as claimed in the online application, without fail.

4.2. After verification of original certificates, the eligible candidates alone will be admitted for counselling. If the candidate does not satisfy the eligibility criteria, his/her online application will be rejected and his/her provisional admission to physical certificate verification will be cancelled and will not be allowed to attend the counselling.

4.3. If the candidate does not appear for the physical certificate verification on the scheduled date and time, the candidate will not be given any further chance to appear for the physical certificate verification and will not be allowed to attend the counselling.

#### **5. Counselling**

5.1. Candidates will be allowed to participate in the counselling based on his / her rank. If the candidate does not appear for the counselling on the scheduled date and time, the candidate will not be given any further chance to appear for the counselling.

5.2. The post chosen by the candidate during the counselling cannot be changed under any circumstances.

**Annexure V**

**1. Form for Certificate for Allocation of Scribe / Compensatory Time**

This is to certify that I have examined Mr/Ms/Mrs. \_\_\_\_\_ (Name of the candidate with disability) a person with \_\_\_\_\_ (Nature and percentage of disability as mentioned in the certificate of disability), S/o/D/o \_\_\_\_\_ a resident of \_\_\_\_\_ (Village / District / State and to state that He / She has physical limitation which hampers his / her writing capabilities owing to his / her disability).

Due to the above mentioned disability following concession may be given:- \*

1. Allocation of a scribe.
2. Compensatory time for writing the examination.

\*strike out the non applicable.

Signature

(Chief Medical Officer / Civil Surgeon / Medical Superintendent / notified Medical Authority of a Government Health Care Institution / Medical Board)

Name & Designation

Name of Government Hospital / Health Care Centre / The notified Medical Authority/ Medical Board

Place:  
Date:

(Photo of the Differently Abled Person and Stamp to be fixed here)

Signature / Thumb impression of the Differently Abled Person

Note:

Certificate should be given by a specialist of the relevant stream / disability

(e.g. Visual Impairment – Ophthalmologist, Locomotor disability – Orthopedic Specialist / PMR etc.,)

## 2. Form for Eye Fitness Certificate

1. Name		
2. Father's Name		
3. Visual standard without glasses	Right Eye	Left Eye
a. Distant Vision (without glasses)		
b. Near Vision (without glasses)		
4. Field Vision		
5. Color Vision		
6. Fundus appearance		
7. Whether suffering from colour blindness? (Yes / No)		
8. Standard Vision		
Date :	Signature of the Specialist in Ophthalmology : Name : Designation : Seal :	
<p><b>Note:</b> Colour blindness is a disqualification for the posts of Drug Inspector (Post Code-1972), Agricultural Officer (Extension) (Post Code-1678), Horticultural Officer (Post Code-3001), Research Assistant (Post Code-1861), Junior Architect (Post Code-1860), Junior Scientific Officer (Post Code.1767), Assistant Engineer (Mechanical) (Post Code.3268), Assistant Manager (IT) (Post Code.3810), Assistant Manager (Civil) (Code.3811), Assistant Geologist (Post Code.1750) and Assistant Manager (Electrical) (Post Code.3812).</p>		

### 3. Certificate of Physical Measurement

A certificate containing the following particulars should be obtained from a Medical Officer, above the rank of an Assistant Surgeon appointed by the Government to Government Medical Institution on or after the date of Notification (20.05.2026) and submit the documents when called for by the Commission.

Height : cms

Chest (on full expiration) : cms

Chest (on full inspiration) : cms

Difference (expansion) : cms

(The measurements should be specified only with reference to metric system)

(Applicants should upload the certificate of physical measurement as mentioned above.)

#### 4. Certificate from the Head of Institution/ University

Photograph of  
the candidate  
with the  
signature of  
the authorised  
signatory

This is to certify that Thiru/Tmt/Selvi. \_\_\_\_\_ son/ daughter of Thiru/Tmt. \_\_\_\_\_ bearing Register no. \_\_\_\_\_, completed the \_\_\_\_\_ course during the academic year \_\_\_\_\_ to \_\_\_\_\_ in our Institution/University. He/ she has successfully completed all the requirements of the course/program and results for all subjects were declared on \_\_\_\_\_

Office Seal:

Date:

Signature (with Seal) of the  
Authorised Signatory of the Institution/  
University  
(Controller of Examinations/ Principal/  
Dean/ Registrar)

**5. Undertaking for spelling mistake in the Name/Mistake in the initial of the candidate in the certificate**

I, \_\_\_\_\_, son/daughter of \_\_\_\_\_, hereby declare that spelling of my name/initial\* has been wrongly mentioned as \_\_\_\_\_ in the \_\_\_\_\_ Certificate uploaded by me.

My correct name is \_\_\_\_\_, and both names refer to one and the same.

\* Strike out whichever is not applicable

Date: \_\_\_\_\_

Place: \_\_\_\_\_

Signature of Candidate: \_\_\_\_\_

Name: \_\_\_\_\_

Notification No. & Date: \_\_\_\_\_

**6. Undertaking for spelling mistake in the Name/Mistake in the initial of the Father/Mother's name in the certificate**

I, \_\_\_\_\_, son/daughter of \_\_\_\_\_, residing at \_\_\_\_\_ do hereby declare that in the Community Certificate uploaded by me, my Father's/Mother's Name /initial\* has been wrongly mentioned as \_\_\_\_\_ instead of \_\_\_\_\_.

Both the above names refer to one and the same.

\* Strike out whichever is not applicable

Date: \_\_\_\_\_

Place: \_\_\_\_\_

Signature of Candidate: \_\_\_\_\_

Name: \_\_\_\_\_

Notification No. & Date. \_\_\_\_\_

**Annexure VI**

Sl. No.	Post	Post Code	Department / Organization	Unit / District / Division / State	Category	Vacancies	Total
1.	Assistant Geologist	1863	Geology and Mining	State	GT(G)	1	8
					GT(G) (PSTM)	1	
					GT(W)	1	
					BC(OBCM) (G) (PSTM)	1	
					BC(M)(G)(PSTM)	1	
					MBC/DC(G)	1	
					SC(A)(W)(PSTM)	1	
					SC(G)	1	
					Total	8	
2.	Assistant Geologist	1677	Agricultural Engineering	State	GT(G)	1	2
					SC(W)	1	
					Total	2	
3.	Assistant Engineer (Agricultural Engineering)	1667	Agricultural Engineering	State	GT(G)	11	64
					GT(G) (PSTM)	3	
					GT(W)	4	
					GT(W)(PSTM)	2	
					BC(OBCM) (G)	9	
					BC(OBCM) (G) (PSTM)	3	
					BC(OBCM)(W)	4	
					BC(OBCM)(W)(PSTM)	1	
					BC(M)(G)(LD/LC/DF/AC)	1	
					BC(M)(W)	1	
					MBC/DC(G)	7	
					MBC/DC(G) (PSTM)	2	
					MBC/DC(W)	2	
					MBC/DC(W)(HH/Hi)	1	
					MBC/DC(W)(PSTM)	1	
					SC(G)	5	
					SC(G) (PSTM)	1	
					SC(W)	1	
					SC(W)(PSTM)	2	
					SC(A)(LV)	1	
SC(A)(W)	1						
ST(G)	1						
Total	64						
4.	Agriculture Officer (Extension)	1678	Agriculture	State	GT(G)	1	11
					GT(G) (PSTM)	1	
					GT(W)	1	
					BC(OBCM) (G)	1	
					BC(OBCM) (G) (PSTM)	1	
					BC(M)(W)	1	
					MBC/DC(G)	1	
					MBC/DC(W)	1	
					SC(A)(W)	1	
					SC(G)	1	
					SC(W)	1	
					Total	11	

5.	Drug Inspector	1972	Drug Control Administration	State	BL_MBC/DC(G) (LD) (Lower limb 40 to 70%)	1	9
					GT(G)	1	
					GT(W)	1	
					BC(OBCM) (G)	1	
					BC(OBCM)(W)(PSTM)	1	
					MBC/DC(G)	1	
					MBC/DC(G) (PSTM)	1	
					SC(G)(PSTM)	1	
					SC(W)(PSTM)	1	
					Total	9	
6.	Horticultural Officer	3001	Horticulture	State	BL_BC(OBCM) (G)	1	17
					BL_MBC/DC(G) (LV)	1	
					GT(G)	1	
					GT(G) (PSTM)	1	
					GT(W)	1	
					GT(W)(HH/HI)	1	
					BC(OBCM) (G)	2	
					BC(OBCM) (G) (PSTM)	1	
					BC(OBCM)(W)	1	
					MBC/DC(G)	1	
					MBC/DC(W)	1	
					SC(G)	2	
					SF_SC	2	
					SF_ST	1	
Total	17						
7.	Assistant Engineer	1661	Highways	State	GT(G)	6	38
					GT(G) (PSTM)	1	
					GT(W)	2	
					GT(W)(PSTM)	2	
					BC(OBCM) (G)	6	
					BC(OBCM) (G) (PSTM)	1	
					BC(OBCM)(W)	3	
					BC(OBCM)(W)(HH)	1	
					BC(M)(W)	1	
					MBC/DC(G)	4	
					MBC/DC(G) (HH)	1	
					MBC/DC(G) (PSTM)	1	
					MBC/DC(W)	1	
					MBC/DC(W)(PSTM)	1	
					SC(G)	3	
					SC(G) (PSTM)	1	
SC(W)	2						
SC(A)	1						
Total	38						
8.	Assistant Director (Industrial Safety and Health)	1664	Industrial Safety and Health	State	GT(G)	2	3
					BC(OBCM) (G)	1	
					Total	3	

9.	Junior Assistant Director of Boilers	3008	Public Works	State	GT(G)	1	2
					SC(A)(W)(PSTM)	1	
					Total	2	
10.	Junior Architect	1860	Public Works	State	BL_MBC/DC(G) (AC/LD(OL/BL))	1	5
					GT(G)	1	
					BC(OBCM) (G)	1	
					MBC/DC(W)	1	
					SC(G)	1	
					Total	5	
11.	Assistant Engineer (Civil)	3656	Public Works	State	GT(G)	2	14
					GT(G) (PSTM)	1	
					GT(W)	1	
					BC(OBCM) (G)	2	
					BC(OBCM) (G) (PSTM)	1	
					BC(OBCM)(W)	1	
					MBC/DC(G)	1	
					MBC/DC(G) (PSTM)	1	
					MBC/DC(W)(PSTM)	1	
					SC(A)	1	
					SC(G)	2	
					Total	14	
					12.	Assistant Engineer (Electrical)	
GT(G) (PSTM)	1						
BC(OBCM) (G)	2						
BC(OBCM) (G) (PSTM)	1						
BC(OBCM)(W)	1						
BC(M)(W)	1						
MBC/DC(G) (LD(OA/OL), DF,AC)	1						
MBC/DC(G) (PSTM)	1						
SC(G)	2						
SC(W)	1						
Total	13						
13.	Assistant Engineer	1660	Rural Development and Panchayat Raj	State			GT(G)
					GT(G) (PSTM)	2	
					GT(W)	4	
					GT(W)(PSTM)	1	
					BC(OBCM) (G)	7	
					BC(OBCM) (G) (LD(OA,OL)LC,AC,DF)	1	
					BC(OBCM) (G) (PSTM)	1	
					BC(OBCM)(W)	3	
					BC(OBCM)(W)(PSTM)	1	
					BC(M)(G)	1	
					BC(M)(G)(PSTM)	1	
					MBC/DC(G)	5	
					MBC/DC(G) (PSTM)	2	
					MBC/DC(W)	2	
					MBC/DC(W)(LD(OA,OL), LC,AC,DF)	1	

					SC(G)	4	
					SC(G) (PSTM)	1	
					SC(W)	3	
					SC(A)	1	
					ST(G) (PSTM)	1	
					Total	50	
14.	Assistant Engineer (Civil)	1656	Water Resources	State	GT(G)	6	33
					GT(G) (PSTM)	1	
					GT(W)	2	
					GT(W)(PSTM)	1	
					BC(OBCM) (G)	4	
					BC(OBCM) (G) (PSTM)	1	
					BC(OBCM)(W)	1	
					BC(OBCM)(W)(HH)	1	
					BC(OBCM)(W)(PSTM)	1	
					BC(M)(G)	1	
					MBC/DC(G)	5	
					MBC/DC(W)	1	
					MBC/DC(W)(PSTM)	1	
					SC(G)	3	
					SC(G) (PSTM)	1	
					SC(W)	1	
					SC(A)	1	
					ST(G) (PSTM)	1	
					Total	33	
15.	Assistant Geologist	1750	Water Resources	State	GT(G)	1	9
					GT(W)	1	
					BC(OBCM) (G)	1	
					BC(OBCM) (G) (PSTM)	1	
					BC(M)(G)	1	
					MBC/DC(G)	1	
					MBC/DC(W)	1	
					SC(G)	1	
					SC(W)(PSTM)	1	
					Total	9	
16.	Assistant Engineer (Civil)	3230	Tamil Nadu Urban Habitat Development Board	State	BL_(BC(OBCM) (G) (HH)	1	1
					Total	1	
17.	Assistant Engineer	3269	Tamil Nadu Pollution Control Board	State	MBC/DC(W)	1	1
					Total	1	
18.	Environmental Scientist	3606	Tamil Nadu Pollution Control Board	State	GT(W)(PSTM)	1	4
					BC(OBCM)(W)	1	
					MBC/DC(W)	1	
					SC(W)	1	
					Total	4	
19.	Architectural Assistant / Planning Assistant	2108	Town and Country Planning	State	GT(G)	1	3
					BC(OBCM) (G)	1	
					SC(G) (PSTM)	1	
					Total	3	

20.	Assistant Engineer (Industries)	1900	Industries and Commerce	State	SF_ST(G)	1	1	
					Total	1		
21.	Assistant Manager (IT)	3810	Electronics Corporation of Tamil Nadu Limited	State	GT(G)	1	4	
					BC(OBCM) (G)	1		
					MBC/DC(G)	1		
					SC(A)(W)(PSTM)	1		
					Total	4		
22.	Assistant Manager (Civil)	3811	Electronics Corporation of Tamil Nadu Limited	State	GT(G)	1	2	
					SC(A)(W)(PSTM)	1		
					Total	2		
23.	Assistant Manager (Electrical)	3812	Electronics Corporation of Tamil Nadu Limited	State	GT(G)	1	2	
					SC(A)(W)(PSTM)	1		
					Total	2		
24.	Assistant Accounts Officer	3814	Tamil Nadu Medical Services Corporation Limited	State	GT(G)	1	1	
					Total	1		
25.	Archaeological Officer	1843	Archaeology	State	GT(G)	2	10	
					GT(G) (HH)	1		
					GT(W)	1		
					BC(OBCM) (G)	2		
					MBC/DC(G)	1		
					MBC/DC(W)	1		
					SC(G) (PSTM)	1		
					SC(W)	1		
					Total	10		
26.	Research Assistant	1861	Evaluation and Applied Research	State	GT(G)	1	2	
					MBC/DC(G)	1		
					Total	2		
27.	Junior Scientific Officer	1767	Forensic Science	State	GT(G)	1	6	
					GT(W)	1		
					BC(OBCM) (G) (PSTM)	2		
					MBC/DC(W)	1		
					SC(G)	1		
					Total	6		
28.	Assistant Superintendent of Approved Schools (Men & Women)	2078	Child Welfare and Special Services	State	Men	MBC/DC(G)	1	2
					Women	GT(G)	1	
					Total	2		
29.	Assistant Engineer (Civil)	3368	State Industries Promotion Corporation of Tamil Nadu	State	GT(G)	1	2	
					MBC/DC(G)	1		
					Total	2		
30.	System Manager	3664	Civil Supplies and Consumer Protection	State	BC(OBCM) (G)	1	1	
					Total	1		

31.	Translator	3106	Law	State	BC(OBCM)(W)	1	2
					MBC/DC(G) (PSTM)	1	
					Total	2	
32.	Librarian	1845	Agriculture	State	MBC/DC(G)	1	1
					Total	1	
33.	Statistical Assistant	3125	Food Safety and Drug Administration	State	BC(OBCM) (G)	1	1
					Total	1	
34.	Deputy Manager (Dairying)	3279	Tamil Nadu Co-operative Milk Producers' Federation Limited	State	BL_GT(G) (HH)	1	2
					BL_MBC/DC(G) (LD(OA/ OL),DF,AC)	1	
					Total	2	
35.	Assistant Engineer (Mechanical)	3611	Tamil Nadu Magnesites Limited	State	GT(W)	1	3
					BC(OBCM) (G)	1	
					SC(G)	1	
					Total	3	
36.	Assistant Archaeological Officer	1842	Archaeology	State	GT(G)	1	10
					GT(G) (PSTM)	1	
					GT(W)	1	
					BC(OBCM) (G)	2	
					BC(OBCM)(W)	1	
					MBC/DC(G)	1	
					MBC/DC(W)	1	
					SC(G)	1	
					SC(W)	1	
					Total	10	
37.	Assistant Tourist Officer, Grade II	3111	Tourism	State	GT(G)	1	4
					BC(OBCM) (G)	1	
					MBC/DC(W)(PSTM)	1	
					SC(G)	1	
					Total	4	
38.	Assistant Statistical Investigator	1824	Economics and Statistics	State	GT(G)	3	13
					GT(W)	2	
					BC(OBCM) (G)	1	
					BC(OBCM) (G) (LV/VI)	1	
					BC(OBCM) (G) (PSTM)	1	
					MBC/DC(G)	1	
					MBC/DC(G) (PSTM)	1	
					SC(A)	1	
					SC(G)	1	
					SC(W)	1	
					Total	13	
39.	Block Health Statistician	2010	Family Welfare	State	BL_SC(G) (HH/HI)	1	62
					GT(G)	10	
					GT(DW)	1	
					GT(EXSER)	1	
					GT(G) (PSTM)	3	
					GT(W)	3	
					GT(W)(LV/VI)	1	

					GT(W)(PSTM)	1	
					BC(OBCM) (G)	9	
					BC(OBCM)(DW)	1	
					BC(OBCM)(EXSER)	1	
					BC(OBCM) (G) (PSTM)	2	
					BC(OBCM)(W)	2	
					BC(OBCM)(W)(LD/CP/ LC/DF/AC/MuD)	1	
					BC(OBCM)(W)(PSTM)	1	
					BC(M)(G)	1	
					BC(M)(W)	1	
					MBC/DC(G)	5	
					MBC/DC(G) (ASD/ID/SLD/MI/MD)	1	
					MBC/DC(DW)	1	
					MBC/DC(EXSER)	1	
					MBC/DC(PSTM)	1	
					MBC/DC(W)	2	
					MBC/DC(W)(PSTM)	1	
					SC(G)	4	
					SC(PSTM)	1	
					SC(W)	3	
					SC(A)	1	
					SC(A)(W)	1	
					Total	62	
40.	Junior Photographer	3805	Tamil Development and Information	State	GT(G)	3	23
					GT(DW)	1	
					GT(PSTM)	1	
					GT(W)	1	
					BC(OBCM) (G)	3	
					BC(OBCM)(DW)	1	
					BC(OBCM) (G) (PSTM)	1	
					BC(OBCM)(W)	1	
					BC(M) (G)	1	
					MBC/DC(G)	2	
					MBC/DC(DW)	1	
					MBC/DC(G) (PSTM)	1	
					MBC/DC(W)	1	
					SC(A)(DW)(PSTM)	1	
					SC(G)	2	
					SC(DW)	1	
					SC(G)(PSTM)	1	
					Total	23	
41.	Assistant Librarian	2013	Legal Studies	State	GT(DW)	1	5
					BC(OBCM) (G)	1	
					MBC/DC(G)	1	
					SC(A)(DW)(PSTM)	1	
					SC(G)	1	
					Total	5	

42.	Assistant Warehouse Manager / Junior Assistant	3388	Tamil Nadu Warehousing Corporation Limited	State	SF_ST(G)	1	1
					Total	1	
43.	Junior Chemist	3609	Tamil Nadu Magnesites Limited	State	GT(DW)	1	3
					BC(OBCM) (G)	1	
					SC(G)	1	
					Total	3	
44.	Assistant Engineer (Mechanical)	3268	Tamil Nadu Power Distribution Corporation Limited	State	BL_BC(OBCM) (G)(HH)	1	1
					Total	1	
45.	Assistant General Manager / Regional Manager	3798	Tamil Nadu Handloom Weavers Co-operative Society Limited	State	GT(G)	1	10
					GT(W)	1	
					BC(OBCM) (G)	1	
					BC(OBCM)(W)	1	
					MBC/DC(G)	1	
					MBC/DC(W)	1	
					SC(G)	1	
					SC(A)(W)(PSTM)	1	
					SF_SC(G)	2	
					Total	10	
					<b>Total</b>		<b>461</b>