



TAMIL NADU PUBLIC SERVICE COMMISSION

Advertisement No.690

Notification No.9/2024

Date: 26.07.2024

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 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		26.07.2024	
Last date and time for submission of online application		24.08.2024 11.59 pm	
Application Correction Window period		28.08.2024 12.01 am to 30.08.2024 11.59 pm	
Date and Time of Examination			
Paper - I			
Subject		Date	Time
Tamil Eligibility Test, General Studies and Aptitude and Mental Ability Test		26.10.2024	09.30 am to 12.30 pm
Paper - II			
Subject Paper		Subject Code	Date
Agriculture		284	14.10.2024 to 23.10.2024 (excluding 19.10.2024 and 20.10.2024)
Archaeology (Degree)		313	
Archaeology (PG Degree)		314	
Anthropology (Degree)		417	
Anthropology (PG Degree)		312	
Architecture		401	
Basics of Engineering		422	
Bio Chemistry		460	
Bio-Technology		461	
Botany (Degree)		268	
Botany (PG Degree)		269	

Business Administration	385	14.10.2024 to 23.10.2024 (excluding 19.10.2024 and 20.10.2024)
Chemical Technology	290	
Chemistry (Degree)	430	
Chemistry (PG Degree)	244	
Chemical Engineering	405	
Civil Engineering	398	
Clinical Pharmacology	352	
Computer Application	289	
Computer Science	287	
Computer Science and Engineering	407	
Dairy Chemistry	468	
Dairy Science	458	
Dairy Technology	456	
Economics	416	
Electrical and Electronics Engineering	400	
Electronics and Communication Engineering	403	
Evaluation and Applied Research	213	
Food Technology / Food Processing	455	
Financial and Cost Accountancy (Intermediate)	433	
Geology (Degree)	394	
Geology (PG Degree)	395	
History (Degree)	315	
History (PG Degree)	317	
Information Technology	408	
Law	414	
Library and Information Science	266	
Mathematics	419	
Mechanical / Manufacturing / Production Engineering	399	
Microbiology	459	
Microbiology (Medicine)	351	
Pharmacy / Pharmaceutical Sciences	429	
Physics	241	
Sanskrit (Degree)	318	
Sanskrit (PG Degree)	319	
Statistics	418	
Textile Technology	406	
Town and Country Planning	382	
Travel and Tourism	353	
Translation	462	
Zoology (Degree)	270	
Zoology (PG Degree)	271	

1.2.1. The date and time of examination for the Paper-II-Subject Paper, will be informed only through Commission's website 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. 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 28.08.2024 to 30.08.2024. 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.

1.4. 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 and 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 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	Distribution of Vacancies		Number of Vacancies	Level of Pay
1	Assistant Engineer (Civil)	3351	Tamil Nadu Police Housing Corporation Ltd.,	GT (G)	1	05	Level 20 (EPF)
				GT(W)	1		
				BC (G) (OBCM) (PSTM)	1		
				SC (W)	1		
				ST (G) (PSTM)	1		
2	Assistant Engineer (Civil)	3232	Chennai Metropolitan Development Authority	GT (G) (HH)	1	01 *	
3	Agricultural Officer (Extension)	1678	Agriculture	GT (G)	4	32	Level 20 (CPS)
				GT (G) (LD/ CP/ LC/ DF/ AC/ MuD)	1		
				GT (G) (PSTM)	2		
				GT(W)	2		
				GT(W) (PSTM)	1		
				BC (OBCM) (G)	4		
				BC (OBCM) (G) (PSTM)	2		
				BC (OBCM) (W)	2		
				BC (OBCM) (W) (PSTM)	1		
				MBC/DC (G)	3		
				MBC/DC (G) (PSTM)	1		
				MBC/DC (W)	1		
				MBC/DC (W) (PSTM)	1		
				BC(M) (G)	1		
				SC (G)	3		
				SC (G) (PSTM)	1		
				SC (W)	1		
				SC(A) (G)	1		
4	Architectural Assistant/ Planning Assistant	2108	Town and Country Planning	SC (G)	1	03 *	
				GT (W)	1		
				BC (OBCM) (W)	1		
5	Assistant Director	1664	Industrial Safety and Health	GT (W)	1	04	
				BC (OBCM) (W)	1		
				MBC/DC (G)	1		
				SC (G)	1		
6	Assistant Engineer (Civil)	1656	Water Resources	GT (G)	19	115	
				GT (G) (LD(OA, OL) DF/ AC)	1		
				GT (G) (PSTM)	5		
				GT (W)	7		
				GT (W) (HH)	1		
				GT (W) (PSTM)	2		
				BC (OBCM) (G)	16		
				BC (OBCM) (G) (HH)	1		
				BC (OBCM) (G) (LD(OA,OL) DF/ AC)	1		
				BC (OBCM) (G) (PSTM)	4		

				BC (OBCM) (W)	7		
				BC (OBCM) (W) (PSTM)	2		
				MBC/DC (G)	12		
				MBC/DC (G) (PSTM)	4		
				MBC/DC (W)	5		
				MBC/DC (W) (HH)	1		
				MBC/DC (W) (PSTM)	1		
				BC(M) (G)	2		
				BC(M) (G) (PSTM)	1		
				BC(M) (W) (PSTM)	1		
				SC (G)	10		
				SC (G) (PSTM)	2		
				SC (W)	4		
				SC (W) (PSTM)	1		
				SC(A) (G)	2		
				SC(A) (G) (PSTM)	1		
				SC(A) (W)	1		
				ST (G) (PSTM)	1		
7	Assistant Engineer (Civil)	3656	Public Works	GT (G)	7	45	
				GT (G) (LD(OA/OL)/ DF/ AC)	1		
				GT (G) (PSTM)	2		
				GT (W)	4		
				GT (W) (PSTM)	1		
				BC (OBCM) (G)	6		
				BC (OBCM) (G) (PSTM)	2		
				BC (OBCM) (W)	4		
				MBC/DC (G)	3		
				MBC/DC (G) (LD(OA/OL)/ DF/ AC)	1		
				MBC/DC (G) (PSTM)	1		
				MBC/DC (W)	3		
				BC(M) (G)	1		
				SC (G)	4		
				SC (G) (PSTM)	1		
				SC (W)	2		
				SC(A) (G)	1		
				ST (G)	1		
8	Assistant Engineer	1661	Highways	GT (W)	1	03	
				MBC/DC(G)	1		
				SC (G)	1		
9	Assistant Engineer (Electrical)	1657	Public Works	GT (G)	11	67	
				GT (G) (PSTM)	3		
				GT (W)	5		
				GT (W) (PSTM)	2		
				BC (OBCM) (G)	9		
				BC (OBCM) (G) (PSTM)	3		
				BC (OBCM) (W)	4		
				BC (OBCM) (W) (HH)	1		
				BC (OBCM) (W) (PSTM)	1		
				MBC/DC (G)	7		
				MBC/DC (G) (HH)	1		

Level
20
(CPS)

				MBC/DC (G) (PSTM)	1		
				MBC/DC (W)	4		
				MBC/DC (W) (PSTM)	1		
				BC(M) (G)	2		
				SC (G)	6		
				SC (G) (PSTM)	1		
				SC (W)	1		
				SC (W) (PSTM)	1		
				SC(A) (G)	1		
				SC(A) (W)	1		
				ST (G)	1		
10	Assistant Engineer (Electrical)	3487	Hindu Religious and Charitable Endowments	GT (G)	2	13	
				GT(G)(PSTM)	1		
				GT(W)	1		
				BC(OBCM)(G)	2		
				BC (OBCM)(W)	1		
				MBC/DC (G)	2		
				MBC/DC (W)	1		
				SC(G)	1		
				SC(W)	1		
				SC(A)(W)(PSTM)	1		
11	Assistant Engineer (Industries)	1900	Industries and Commerce	GT (G)	1	01	
12	Assistant Geologist	1677	Agricultural Engineering	BC (OBCM) (G)	1	01	
13	Assistant Geologist	1863	Geology and Mining	GT (G)	1	05	
				GT (W) (PSTM)	1		
				BC (OBCM) (G) (LV)	1		
				BC (OBCM) (W)	1		
				MBC/DC (G) (PSTM)	1		
14	Assistant Geologist	1750	Water Resources	GT (G)	3	14	
				GT (W)	2		
				BC (OBCM) (G)	2		
				BC (OBCM) (G) (PSTM)	1		
				BC (OBCM) (W)	1		
				MBC/DC(G)	1		
				MBC/DC (W)	1		
				BC(M) (G)	1		
				SC (G)	1		
				SC (W) (PSTM)	1		
15	Assistant Engineer	1660	Rural Development and Panchayat Raj	GT (G)	4	18	
				GT (G) (PSTM)	1		
				GT (W)	1		
				BC (OBCM) (G)	3		
				BC (OBCM) (W)	1		
				MBC/DC (G)	1		
				MBC/DC (LD (OA,OL)	1		

Level
20
(CPS)

				/LC/ AC/ DF)			
				MBC/DC (G) (PSTM)	1		
				MBC/DC (W)	1		
				BC(M) (G)	1		
				SC (G)	1		
				SC (G) (PSTM)	1		
				SC(A) (G)	1		
16	Chemist	1913	Industries and Commerce	BC (OBCM) (G) (PSTM)	1	01	
17	Drugs Inspector	1972	Drugs Control Administration	GT (G)	3	15	Level 20 (CPS)
				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) (HH)	1		
				MBC/DC (W)	1		
				SC (G)	1		
				SC (W)	1		
				SC(A) (G)	1		
18	Junior Architect	1860	Public Works	GT (G)	1	05	
				GT (W) (PSTM)	1		
				BC (OBCM) (G)	1		
				MBC/DC (G) (LD (OL,BL) / AC)	1		
				BC(M) (W)	1		
19	Junior Manager (Finance and Accounts)	3352	Tamil Nadu Urban Finance and Infrastructure Development Corporation Ltd.,	GT (G)	1	04	Level 18 (EPF)
				BC (OBCM) (W)	1		
				MBC/DC (W)	1		
				SC (G)	1		
20	Curator (Chemical Conservation)	2127	Museum	Will be announced later		15	
21	Curator	2129					
22	Research Assistant	1861	Evaluation and Applied Research	GT (G) (LV)	1	05 **	Level 18 (CPS)
				BC (OBCM) (G)	1		
				MBC/DC (W)	1		
				SC (G)	1		
				SC (W)	1		
23	Statistical Inspector	1697	Animal Husbandry	GT (G)	1	10	
				GT (PSTM)	1		
				GT (W)	1		
				BC (OBCM) (G)	2		
				BC (OBCM) (W)	1		
				MBC/DC (G)	2		
				SC (G)	1		
				SC(A) (G) (PSTM)	1		

24	Assistant Engineer (Civil)	3350	Tamil Nadu Small Industries Development Corporation Ltd.,	GT (G)	1	05	Level 17 (EPF)	
25	Assistant Manager	3349		GT(W)	1			
				BC (OBCM) (G)	1			
				MBC/DC (G)	1			
				SC(A) (W) (PSTM)	1			
			GT (G)	2				
			GT (G) (PSTM)	1				
			GT (W)	1				
			BC (OBCM) (G)	2				
			BC (OBCM) (G) (PSTM)	1				
			BC (OBCM) (W)	1				
MBC/DC (G)	2							
MBC/DC (W)	1							
BC(M) (G)	1							
SC (G)	1							
SC (W)	1							
SC(A) (W) (PSTM)	1							
26	Assistant Engineer (Civil)	3368	State Industries Promotion Corporation of Tamil Nadu Ltd.,	GT (G)	2	14 *		
				GT(W)	1			
				BC (OBCM) (G)	2			
				BC (OBCM) (G) (PSTM)	1			
				BC (OBCM) (W)	1			
				MBC/DC (G)	2			
				MBC/DC (G) (PSTM)	1			
				MBC/DC (W)	1			
				BC(M) (G)	1			
				SC (G)	1			
SC (G)(PSTM)	1							
27	Junior Analyst	2006	Drugs Control Administration	GT (G) (LV)	1	05 *	Level 16 (CPS)	
				MBC/DC (G) (LD/LC/DF/AC)	1			
				ST(G)	1			
				GT (G) (PSTM)	1			
				BC (OBCM) (W)	1			
28	Translator	3106	Law	BC (OBCM) (G) (PSTM)	1	03		
				MBC/DC (G)	1			
				BC(M) (G)	1			
29	Assistant Librarian	1856	Archives and Historical Research	GT (G)	1	01		Level 15 (CPS)
30	Library Assistant Grade I	1857		GT (G)	1	02		
			SC(A) (W) (PSTM)	1				
31	Librarian Grade I	3347	Labour	GT (G)	1	01		
32	Technical Executive (Mechanical)	3383	Tamil Nadu Cement Corporation Ltd.,	GT (G)	1	13	Level 15 (EPF)	
				GT (G) (PSTM)	1			
				GT (W)	1			
				BC (OBCM) (G)	2			
				BC (OBCM) (G) (PSTM)	1			
				BC (OBCM) (W)	1			
				MBC/DC (G)	2			
				MBC/DC (W)	1			
				SC (G)	1			
				SC (W)	1			
				SC (A) (W) (PSTM)	1			

33	Executive Surveyor	3384	Tamil Nadu Cement Corporation Ltd.,	GT (G)	1	1	Level 15 (EPF)
34	Executive Geologist	3385		GT (G)	1	1	
35	Deputy Manager (System)	3278	Tamil Nadu Co-operative Milk Producers' Federation Ltd.,	GT (W)	1	02	Level 13 (EPF)
				SC (G)	1		
36	Deputy Manager (Dairying)	3279	Tamil Nadu Co-operative Milk Producers' Federation Ltd.,	GT (G)	3	23	
				GT (G) (HH)	1		
				GT (G) (PSTM)	1		
				GT (W)	2		
				BC (OBCM) (G)	4		
				BC (OBCM) (W)	2		
				MBC/DC (G)	2		
				MBC/DC (G) (LD (OA,OL)/ DF/ AC)	1		
				MBC/DC (G) (PSTM)	1		
				MBC/DC (W)	1		
				SC (G)	2		
				SC (G) (PSTM)	1		
				SC (W)	1		
				SC(A) (G) (PSTM)	1		
37	Secretarial Officer (Legal)	3372	Tamil Nadu Industrial Development Corporation Ltd.,	GT (G)	1	01	
38	Foreman (Marine)	1762	Fisheries and Fishermen Welfare	SC (W)	1	01	Level 13 (CPS)
39	Junior Chemist	1914	Industries and Commerce	GT (G) (PSTM)	1	06	
				BC (OBCM) (G) (PSTM)	1		
				MBC/DC (G)	1		
				BC (M) (G)	1		
				SC (G)	1		
				SC (W)	1		
40	Deputy Manager (Quality Assurance)	3348	Tamil Nadu Co-operative Milk Producers' Federation Ltd.,	GT (G)	2	12	Level 12 (EPF)
				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		
				SC(A) (W) (PSTM)	1		
41	X-Ray Analyst	3386	Tamil Nadu Cement Corporation Ltd.,	GT (G)	1	2	Level 12 (EPF)
				BC (OBCM) (G)	1		
42	CCR Operator	3387	Tamil Nadu Cement Corporation Ltd.,	Will be announced later		4 *	

43	Assistant Curator (Zoology)	2131	Museum	SC (G)	1	6 *	Level 10 (CPS)
44	Assistant Curator (National Art Gallery)	2133		MBC / DC (W) (DW)	1		
45	Assistant Curator (Archaeology)	1848		BC(OBCM) (W) (DW)	1		
46	Assistant Curator (Botany)	2132		GT (G)	1		
47	Assistant Curator (Anthropology)	2130		BC(OBCM) (G)	1		
48	Assistant Curator (Pudukottai Government Museum)	3369		GT (G) (PSTM)	1		
49	Assistant Tourist Officer (Grade-II)	3111	Tourism	Will be announced later		23 *	
50	Chemist	3370	Industrial Safety and Health	GT (G)	1	01	
51	Block Health Statistician	2010	Family Welfare	MBC/DC (G) (ASD/ID/SLD/MI/MD)	1	56 * @	
				GT (G)	8		
				GT (W) (DW) (PSTM)	1		
				GT (EX-SER)	1		
				GT (G) (PSTM)	2		
				GT (W)	3		
				GT (W) (PSTM)	1		
				BC (OBCM) (G)	8		
				BC (OBCM) (EX-SER)	1		
				BC (OBCM) (G) (PSTM)	2		
				BC (OBCM) (W)	3		
				BC (OBCM) (W) (PSTM)	1		
				MBC/DC (G)	6		
				MBC/DC (EX-SER)	1		
				MBC/DC (G) (PSTM)	1		
				MBC/DC (W)	2		
				MBC/DC (W) (PSTM)	1		
				BC(M) (G) (LD/CP/LC/DF/AC/MuD)	1		
				BC(M) (W)	1		
				SC (G)	4		
				SC (W) (DW) (PSTM)	1		
				SC (EX-SER)	1		
				SC (G) (PSTM)	1		
				SC (W) (PSTM)	1		
				SC(A) (G)	1		
				SC(A) (W)	1		
				ST (G)	1		

52	Store Keeper	1768	Forensic Sciences	GT (W)	1	01	Level 08 (CPS)
53	Assistant Warehouse Manager / Junior Assistant	3388	Tamil Nadu Warehousing Corporation	GT (G)	10	73 @	Level 08 (EPF)
				GT (W) (DW)	1		
				GT (EX-SER)	1		
				GT (G) (LV/VI)	1		
				GT (G) (PSTM)	3		
				GT (W)	4		
				GT (W) (HH/VI)	1		
				GT (W) (PSTM)	1		
				BC (OBCM) (G)	10		
				BC (OBCM)(W)(DW)	1		
				BC (OBCM) (EX-SER)	1		
				BC (OBCM) (G) (PSTM)	2		
				BC (OBCM) (W)	4		
				BC (OBCM) (W) (PSTM)	1		
				MBC/DC (G)	6		
				MBC/DC (W) (DW)	1		
				MBC/DC (EX-SER)	1		
				MBC/DC (G) (LD/CP/LC/DFR/AC//MuD)	1		
				MBC/DC (G) (PSTM)	2		
				MBC/DC (W)	3		
				MBC/DC (W) (PSTM)	1		
				BC(M) (G)	1		
				BC(M) (W) (DW)	1		
				SC (G)	6		
				SC (W) (DW)	1		
				SC (EX-SER)	1		
				SC (G) (PSTM)	1		
				SC (W)	2		
				SC(A) (G)	1		
				SC (A) (W) (DW) (PSTM)	1		
				SC (A) (G) (PSTM)	1		
				ST (G) (PSTM)	1		
Total						654	
* Including backlog vacancies ** Including shortfall vacancies @ Vacancies for reservation for meritorious sports persons are deducted.							
Abbreviations: CPS – Contributory Pension Scheme EPF – Employees Provident Fund							

3.1. The number of vacancies notified is tentative and is liable for modification, before the publication of the results of the examination. 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.

4. Eligibility Conditions:

4.1. Age Limit: (as on 01.07.2024)

The candidates should have completed the age of 21 years for all the posts, except for the post of Foreman Marine (Post Code: 1762). For the post of Foreman Marine the candidates should have completed 18 years. 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-Service men	Destitute Widow
1	Assistant Director	1664	32	NA	50	No Maximum Age Limit
2	Assistant Geologist	1750				
3	Assistant Tourist Officer (Grade-II)	3111				
4	Curator (Chemical Conservation)	2127				
5	Curator	2129				
6	Chemist	1913				
7	Junior Chemist	1914				
8	Statistical Inspector	1697				
9	Library Assistant Grade I	1857				
10	Assistant Engineer (Civil)	3351				
11	Assistant Engineer (Civil)	3368				
12	Assistant Manager	3349				
13	Assistant Engineer (Civil)	3350				
14	Translator	3106				
15	Assistant Engineer (Electrical)	3487				
16	Assistant Engineer (Industries)	1900	37			
17	Assistant Curator (Zoology)	2131	32	42	50	No Maximum Age Limit
18	Assistant Curator (National Art Gallery)	2133				
19	Assistant Curator (Archaeology)	1848				
20	Assistant Curator (Botany)	2132				
21	Assistant Curator (Anthropology)	2130				
22	Assistant Curator (Pudukottai Government Museum)	3369				
23	Assistant Engineer (Civil)	1656				
24	Assistant Engineer (Civil)	3656				
25	Assistant Engineer	1661				
26	Assistant Engineer (Electrical)	1657				
27	Assistant Engineer	1660				
28	Assistant Engineer (Civil)	3232				
29	Assistant Geologist	1677				

30	Assistant Geologist	1863	32	42	50	No Maximum Age Limit
31	Assistant Librarian	1856				
32	Block Health Statistician	2010				
33	Deputy Manager (System)	3278				
34	Deputy Manager (Dairying)	3279				
35	Deputy Manager (Quality Assurance)	3348				
36	Drugs Inspector	1972				
37	Junior Analyst	2006				
38	Junior Architect	1860				
39	Research Assistant	1861				
40	Store Keeper	1768				
41	Junior Manager (Finance and Accounts)	3352				
42	Architectural Assistant/ Planning Assistant	2108				
43	Secretarial Officer (Legal)	3372				
44	Technical Executive (Mechanical)	3383				
45	Executive Surveyor	3384				
46	Executive Geologist	3385				
47	X-Ray Analyst	3386				
48	CCR Operator	3387				
49	Assistant Warehouse Manager / Junior Assistant	3388				
50	Chemist	3370	33	43		
51	Foreman (Marine)	1762	37	47		
52	Librarian Grade I	3347				
53	Agricultural Officer (Extension)	1678	32*	42 **		
* 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., NA - Not Applicable, since persons with benchmark disability are not eligible to apply for this post.						

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

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 Director	1664	No maximum age limit	NA	No maximum age limit	
2	Assistant Engineer (Industries)	1900				
3	Chemist	1913				
4	Junior Chemist	1914				
5	Assistant Engineer (Civil)	3351				
6	Assistant Engineer (Civil)	3350				
7	Assistant Engineer (Electrical)	3487				
8	Assistant Manager	3349				
9	Curator (Chemical Conservation)	2127				

10	Curator	2129	No maximum age limit	NA	No maximum age limit
11	Assistant Geologist	1750			
12	Assistant Tourist Officer (Grade-II)	3111			
13	Statistical Inspector	1697			
14	Translator	3106			
15	Library Assistant Grade I	1857	No Maximum age limit		
16	Agricultural Officer (Extension)	1678			
17	Architectural Assistant / Planning Assistant	2108			
18	Assistant Curator (Zoology)	2131			
19	Assistant Curator (National Art Gallery)	2133			
20	Assistant Curator (Archaeology)	1848			
21	Assistant Curator (Botany)	2132			
22	Assistant Curator (Anthropology)	2130			
23	Assistant Curator (Pudukottai Government Museum)	3369			
24	Assistant Engineer (Civil)	1656			
25	Assistant Engineer (Civil)	3656			
26	Assistant Engineer	1661			
27	Assistant Engineer (Electrical)	1657			
28	Assistant Engineer (Civil)	3232			
29	Assistant Geologist	1677			
30	Assistant Geologist	1863			
31	Assistant Librarian	1856			
32	Block Health Statistician	2010			
33	Chemist	3370			
34	Deputy Manager (System)	3278			
35	Deputy Manager (Dairying)	3279			
36	Deputy Manager (Quality Assurance)	3348			
37	Drugs Inspector	1972			
38	Foreman (Marine)	1762			
39	Junior Analyst	2006			
40	Junior Architect	1860			
41	Librarian Grade I	3347			
42	Research Assistant	1861			
43	Secretarial Officer (Legal)	3372			
44	Store Keeper	1768			
45	Junior Manager (Finance and Accounts)	3352			
46	Assistant Engineer	1660			
47	Technical Executive (Mechanical)	3383			
48	Executive Surveyor	3384			
49	Executive Geologist	3385			
50	X-Ray Analyst	3386			
51	CCR Operator	3387			
52	Assistant Warehouse Manager / Junior Assistant	3388			

53	Assistant Engineer (Civil)	3368	BC(OBCM)s, BCMs MBCs/DCs-34, SCs, SC(A)s, STs-37	NA	BC(OBCM)s, BCMs MBCs/DCs-34, SCs, SC(A)s, STs-37
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 1.7.2024 or at the time of selection / appointment to the post.

4.1.4. 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. Supporting Documents:

4.2.1. 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.

4.2.2. Those candidates whose date of birth is not mentioned in their tenth standard / twelfth standard mark sheet must upload / produce their Birth Certificate / Transfer Certificate/ Degree Mark Sheets, instead of the tenth standard or twelfth standard mark sheet. Any other form of evidence will not be accepted.

4.2.3. Failure to upload / produce such a document shall result in the rejection of candidature after due process.

4.3. Educational Qualification, Technical Qualification and Experience:

S. No.	Name of the Post	Post Code	Qualification and Experience
1	Agricultural Officer (Extension)	1678	i) A Bachelor degree in Agriculture and, ii) Must possess adequate knowledge of Tamil
2	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 Institute of Engineers (India)
3	Assistant Curator (Archaeology)	1848	(i) Must possess a degree in Sanskrit with a knowledge of Dravidian languages and Ancient Indian History; or A degree in Archaeology (working knowledge in Sanskrit with high qualification in Sanskrit) and knowledge of Dravidian languages and scripts and Ancient Indian History (ii) If no candidate with the above qualification is available, candidates who possess a degree in

			History with working knowledge of Sanskrit shall be considered (iii) Persons who possess high qualification in Sanskrit shall be preferred
4	Assistant Curator (Anthropology)	2130	(i) B.Sc., in Zoology or a degree in Anthropology. (ii) Preference shall be given to the candidates possessing Diploma in Anthropology in the case of degree holders in Zoology
5	Assistant Curator (Zoology)	2131	A Degree B.Sc., in Zoology, with Botany or Chemistry or Geology as subsidiary subject
6	Assistant Curator (Botany)	2132	A Degree in B.Sc., Botany, with Zoology or Chemistry or Geology as subsidiary subject or A B.Sc., degree in Geology, with Botany or Zoology or Chemistry as subsidiary subject
7	Assistant Curator (National Art Gallery)	2133	(i) Must possess a degree of B.A in History (ii) Other things being equal, preference shall be given to candidates who possess, in addition, a Diploma in Fine Arts and knowledge of Art History
8	Assistant Curator (Pudukottai Government Museum)	3369	A degree in any of the following subjects: Sanskrit with knowledge of Dravidian languages, Ancient History, Archaeology, Zoology, Botany, Geology, History (with working knowledge of Sanskrit)
9	Assistant Director	1664	A Degree in Mechanical or Electrical or Chemical Engineering or Textile Technology or Industrial Engineering or Production Engineering
10	Assistant Engineer (Civil)	1656	(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
11	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

12	Assistant Engineer	1661	(i) Must possess a degree in Civil Engineering or A pass in Sections A and B of the A.M.I.E (India) Examinations (re-named as Institution Examinations) (ii) Other things being equal, preference shall be given to a person who has undergone one year of Apprenticeship training under the Government of India Scheme or one year of training under the State Government Apprenticeship Scheme
13	Assistant Engineer (Civil)	3351	Must possess a Bachelor Degree in Civil Engineering recognised by Tamil Nadu Government or equivalent
14	Assistant Engineer (Civil)	3350	Must be a Graduate in Civil Engineering
15	Assistant Engineer (Civil)	3232	Must possess the Bachelor Degree in Civil Engineering
16	Assistant Engineer (Civil)	3368	Must possess B.E./ B.Tech Degree in Civil Engineering from a recognized University / Institution
17	Assistant Engineer	1660	(i) Must possess a B.E degree in Civil Engineering or Must have passed Sections A and B of the Institution of Engineers (India) in Civil Engineering Branch, and he / she should furnish evidence of having undergone practical training in surveying for a period of not less than one year. (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
18	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
19	Assistant Engineer (Electrical)	3487	Must possess Bachelor of Engineering degree in Electrical Engineering or Electronics and Communication Engineering or Electrical and Electronics Engineering or Bachelor of Technology degree in Electrical Engineering or Electrical and Communication Engineering or Electrical and Electronics Engineering or its equivalent awarded by an institute recognized by the All India Council for Technical Education
20	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
21	Assistant Geologist	1677	A degree in M.Sc., (Geology)

22	Assistant Geologist	1863	(i) Must possess M.Sc., Degree in Geology of any University (ii) Other things being equal, preference shall be given to those who possess practical experience in field work
23	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
24	Assistant Tourist Officer (Grade-II)	3111	(i) A 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
25	Chemist	1913	(i) First or Second Class Degree in M.Sc., in Chemistry or Chemical Technology or Industrial Chemistry or Associateship Diploma of the Institution of Chemists (India) obtained by Examination and (ii) Experience in research in Pure or Applied Chemistry or Analytical Chemistry for a period of not less than 2 years
26	Chemist	3370	A first class Bachelor's degree with Chemistry as main subject
27	Junior Chemist	1914	(i) Must possess a First or Second Class Post Graduate Degree in any Branch of Chemistry; or Associateship Diploma of the Institution of Chemists (India) obtained by Examination (ii) Other things being equal, preference shall be given to a candidate who possesses a Post Graduate Degree in Analytical Chemistry or to a candidate who possesses practical experience for a period of not less than one year in any recognized research or Analytical or Metallurgical Laboratory Explanation: a) "Recognized Research Laboratory" means a laboratory recognized by the Ministry of Science and Technology of the Government of India. b) "Recognized Analytical or Metallurgical Laboratory" means a Laboratory, which is engaged in Testing and Analytical and issues Test Certificate
28	Curator (Chemical Conservation)	2127	(i) Must possess the M.Sc degree with Chemistry (Main) and Electro Chemistry as special subject or M.Sc. (Technical) in Chemical Engineering or M.E. (Chemical) degree; and (ii) Must possess research experience with scientific publications (iii) Preference shall be given to candidates who possess, in addition, knowledge of French and German

29	Curator	2129	A Master's or Honours degree in any one of the following subjects: Zoology, Botany, Geology, Anthropology, Indian Archaeology, Sanskrit, History, Chemistry
30	Deputy Manager (System)	3278	Must possess Bachelor Degree in Engineering (Information Technology/ Computer Science) / Bachelor Degree in Technology (Information Technology / Computer Science) / Master of Computer Applications / M.Sc., (Computer Science) from a recognized University
31	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
32	Deputy Manager (Quality Assurance)	3348	Must possess Post Graduate Degree in Dairy Science/ Dairy Chemistry/ Chemistry/ Bio-Chemistry/ Bio-Tech./ Microbiology
33	Drugs 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
34	Foreman (Marine)	1762	(i) Must possess a degree in Mechanical Engineering or Must possess a Post Diploma in Diesel Traction issued by the Tamil Nadu State Board of Technical Education and Training or Must possess a Diploma in Mechanical Engineering awarded by the Tamil Nadu State Board of Technical Education and Training with experience for a period of not less than two years in any workshop or in handling diesel engines (ii) Preference shall be given to those who possess the qualifications in the order referred to above (iii) Preference shall be given to those who possess experience in Marine Diesel Engine for a period of not less than two years or have successfully undergone the Boat Building Foreman Course of training in the Central Institute of Fisheries Operatives
35	Junior Analyst	2006	(i) Must be a graduate in Pharmacy or Chemistry or Pharmaceutical Chemistry and (ii) Should possess not less than two years experience in the analysis of drugs (iii) Provided that the requirement of experience may be reduced to one year in the case of Pharmacy graduates and Post Graduates in Chemistry with Analytical Chemistry as a specific subject
36	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
37	Librarian Grade I	3347	(i) A degree of any University or Institution recognized by the University Grants Commission or Higher Education Commission of India for the purpose of its grant, and (ii) A degree in Library Science from any University recognized by the University Grants Commission or Higher Education Commission of India for the purpose of its grant

38	Assistant Librarian	1856	(i) Must be a graduate (ii) Must have obtained a degree in Library Science
39	Library Assistant Grade I	1857	(i) Must be a graduate (ii) Must have obtained a degree in Library Science
40	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
41	Statistical Inspector	1697	Must possess a Degree of any University or Institution recognised by the University Grants Commission for the purpose of its grant, with Statistics or Mathematics as the main subjects
42	Block Health Statistician	2010	A degree in Statistics or Mathematics or Economics from any University or Institution, recognized by the University Grants Commission
43	Store Keeper	1768	(i) A Degree in Physics or Chemistry and (ii) Experience for a period of not less than three years as Store Keeper in a reputed firm or a Government Institution
44	Translator	3106	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
45	Secretarial Officer (Legal)	3372	(i) Bachelor of Law (B.L) (ii) Preference shall be given to those who possess ACS (Inter)
46	Junior Manager (Finance and Accounts)	3352	(i) A Degree of any University or Institution recognized by the University Grants Commission for the purpose of its grant; and (ii) Must have passed an Intermediate Examination conducted by the Institute of Chartered Accountants of India / Institute of Cost Accountants of India
47	Assistant Manager	3349	(i) MBA Finance or Marketing of a Recognized University and PGDCA Qualification (ii) The candidates who have acquired Degree in Computer Science/Information Technology / Computer Application is exempted from PGDCA Qualification
48	Technical Executive (Mechanical)	3383	B.E., / B.Tech., in Mechanical Engineering from a recognized University / Institute
49	Executive Surveyor	3384	B.E., / B.Tech., in Civil Engineering from a recognized University / Institute
50	Executive Geologist	3385	Degree in Geology from a recognized University / Institute
51	X-Ray Analyst	3386	B.Sc., Chemistry from a recognized University / Institute
52	CCR Operator	3387	B.E., / B.Tech., in Chemical Engineering from a recognized University / Institute
53	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

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

4.3.2. Supporting Documents:

4.3.2.1. SSLC / HSC / Diploma / Degree / PG Degree / Integrated PG 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.

4.3.2.2. In cases where the Diploma / Degree / PG Degree certificates had been issued after the date of notification, candidates must upload / produce proof (in the form of Provisional Diploma / Degree Certificate / Consolidated Mark Sheet, etc.) of the publication of results of the respective qualification(s) on or before the date of notification.

4.3.2.3. The Under Graduate / Post Graduate degree 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.

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

4.3.2.5. Candidates claiming experience, should upload the experience certificate in the format available in Annexure-V of this notification.

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

4.3.2.7. 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.

4.3.3. Equivalence of Qualification: The Government orders relating to equivalence of qualification are available on the Tamil Nadu Public Service Commission's website. However, if the candidate possesses an equivalence of qualification other than one mentioned in the Commission's website and if Government Orders to this effect have been issued on or before the date of this notification, candidates should furnish the details of the same while applying and should upload a copy of the Government Order at the time of uploading of documents, failing which his / her candidature will be rejected after due process. The Government orders regarding equivalence of qualification issued after the date of this notification will not be considered for this recruitment.

4.4. Medical and Physical Standards:

4.4.1. 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.

4.4.2. 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	Architectural Assistant/ Planning Assistant	2108	Standard-II or better
2	Assistant Director	1664	
3	Assistant Engineer (Civil)	3350	
4	Assistant Engineer (Civil)	3232	
5	Assistant Manager	3349	
6	Assistant Engineer	1661	Standard-II or better Colour Blindness will be a disqualification

7	Agricultural Officer (Extension)	1678	Standard – III or better Colour Blindness will be a disqualification
8	Assistant Geologist	1750	
9	Curator (Chemical Conservation)	2127	
10	Curator	2129	
11	Drugs Inspector	1972	
12	Research Assistant	1861	
13	Junior Architect	1860	
14	Assistant Tourist Officer (Grade-II)	3111	Standard III or better
15	Statistical Inspector	1697	
16	Assistant Curator (Zoology)	2131	
17	Assistant Curator (National Art Gallery)	2133	
18	Assistant Curator (Archaeology)	1848	
19	Assistant Curator (Botany)	2132	
20	Assistant Curator (Anthropology)	2130	
21	Assistant Curator (Pudukottai Government Museum)	3369	
22	Assistant Engineer (Civil)	1656	
23	Assistant Engineer (Civil)	3656	
24	Assistant Engineer (Civil)	3351	
25	Assistant Engineer (Civil)	3368	
26	Assistant Engineer (Electrical)	1657	
27	Assistant Engineer (Electrical)	3487	
28	Assistant Engineer (Industries)	1900	
29	Assistant Geologist	1677	
30	Assistant Geologist	1863	
31	Assistant Librarian	1856	
32	Block Health Statistician	2010	
33	Chemist	1913	
34	Chemist	3370	
35	Deputy Manager (System)	3278	
36	Deputy Manager (Dairying)	3279	
37	Deputy Manager (Quality Assurance)	3348	
38	Foreman (Marine)	1762	
39	Junior Analyst	2006	
40	Junior Chemist	1914	
41	Librarian Grade I	3347	
42	Library Assistant Grade I	1857	
43	Translator	3106	
44	Junior Manager (Finance and Accounts)	3352	
45	Assistant Engineer	1660	
46	Secretarial Officer (Legal)	3372	
47	Technical Executive (Mechanical)	3383	
48	Executive Surveyor	3384	
49	Executive Geologist	3385	
50	X-Ray Analyst	3386	
51	CCR Operator	3387	
52	Assistant Warehouse Manager / Junior Assistant	3388	
53	Store Keeper	1768	Standard III or better Colour Blindness and Night Blindness will be a disqualification

4.4.3. Candidates with defective vision should produce an Eye Fitness certificate from a qualified Eye Specialist working in a Government Hospital, to the Appointing Authority.

4.5. Knowledge in Tamil:

4.5.1. 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.

4.5.2. Candidates must upload/ produce 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.

4.5.3. 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

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.	Agricultural Officer (Extension)	1678	LV, HH, LD, CP, LC, DF, AC, MuD
2.	Architectural Assistant / Planning Assistant	2108	LV, HH, LD (OA, OL), AC, LC, DF
3.	Assistant Engineer (Electrical)	1657	LD (OA, OL), HH, DF, AC
4.	Assistant Engineer (Civil)	1656	
5.	Assistant Engineer (Civil)	3656	
6.	Assistant Engineer (Civil)	3232	LD (OA, OL), HH, LC, DF, AC
7.	Assistant Engineer	1661	HH
8.	Assistant Geologist	1677	LV, HI, HH, LD, LC, DF, AC
9.	Assistant Geologist	1863	LV, HI, HH, LD (with mobility), LC, DF, AC
10.	Junior Manager (Finance and Accounts)	3352	HH, LD (OA, OL, BA, OAOL), AC, DF, LC
11.	Assistant Engineer	1660	HH, LD (OA,OL), LC,AC,DF
12.	Deputy Manager (System)	3278	VI, LV, HI, HH, LD (OA, OL, BL, OAOL) LC, DF, AC
13.	Deputy Manager (Dairying)	3279	HH, LD (OA, OL), DF, AC
14.	Assistant Engineer (Civil)	3351	LD (OA,OL), HH,DF,AC
15.	Drugs Inspector	1972	LD (Lower Limbs 40 to 70%)
16.	Foreman (Marine)	1762	LC, DF, LV
17.	Junior Analyst	2006	LV, HH, LD, LC, DF, AC, ASD, SLD
18.	Junior Architect	1860	HI, LD (OL,BL), AC
19.	Research Assistant	1861	LV, HH, LD, CP, LC, DF, AC, ASD
20.	Technical Executive (Mechanical)	3383	HH, LD (OA, OL)

21.	Assistant Librarian	1856	All categories of benchmark disabilities
22.	Chemist	3370	
23.	Librarian Grade I	3347	
24.	Store Keeper	1768	
25.	Assistant Curator (Zoology)	2131	
26.	Assistant Curator (National Art Gallery)	2133	
27.	Assistant Curator (Archaeology)	1848	
28.	Assistant Curator (Botany)	2132	
29.	Assistant Curator (Anthropology)	2130	
30.	Assistant Curator (Pudukottai Government Museum)	3369	
31.	Deputy Manager (Quality Assurance)	3348	
32.	Block Health Statistician	2010	
33.	Secretarial Officer (Legal)	3372	
34.	X-Ray Analyst	3386	
35.	CCR Operator	3387	
36.	Assistant Warehouse Manager / Junior Assistant	3388	
Abbreviations:			
LV	– Low Vision	BL	– Both Leg
VI	– Visually Impaired	BABL	– Both Arm 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
BLOA	– Both Leg One Arm	DF	– Dwarfism
OA	– One Arm	MuD	– Muscular Dystrophy
OL	– One Leg	ASD	– Autism Spectrum Disorder
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.

4.7. Restrictions on applying for the Examination:

4.7.1. 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.

4.7.2. Persons professing Hindu religion alone are eligible for the posts of Assistant Engineer (Electrical) in the Tamil Nadu Hindu Religious and Charitable Endowments Department. Candidates applying for the post should produce / upload a Community Certificate / Certificate from the Revenue Authorities concerned, in support of the religion claimed in the online application, when called for by the Commission. Failure to upload / produce such a certificate, shall result in the rejection of candidature after due process.

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

S.No.	Name of the Post	Post Code	Department / Organization
1.	Assistant Director	1664	Industrial Safety and Health
2.	Assistant Engineer (Industries)	1900	Industries and Commerce
3.	Chemist	1913	
4.	Junior Chemist	1914	
5.	Assistant Geologist	1750	Water Resources
6.	Assistant Tourist Officer (Grade-II)	3111	Tourism
7.	Statistical Inspector	1697	Animal Husbandry
8.	Assistant Engineer (Civil)	3350	Tamil Nadu Small Industries Development Corporation Ltd.,
9.	Assistant Manager	3349	
10.	Assistant Engineer (Civil)	3368	State Industries Promotion Corporation of Tamil Nadu Ltd.,
11.	Assistant Engineer (Electrical)	3487	Hindu Religious and Charitable Endowments
12.	Curator (Chemical Conservation)	2127	Museum
13.	Curator	2129	
14.	Translator	3106	Law
15.	Library Assistant Grade I	1857	Archives and Historical Research
16.	Executive Surveyor	3384	Tamil Nadu Cement Corporation Ltd.,
17.	Executive Geologist	3385	

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. On screen 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. For the posts not requiring experience 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. For the posts requiring experience the candidates will be admitted to on screen certificate verification in the ratio of 1:5 for all categories. The experience certificate uploaded by the candidates will be verified by the Head of the Department / Organization concerned, during onscreen certificate verification.

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. Marks obtained by the candidates in the Examination (Part B of Paper I and Paper II) would determine final ranking. The final selection will be made based on the total marks obtained by the candidate in the Examination (Part B 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. 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.

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*				
Paper I	SSLC	100	3 hours	150	60	60	Objective	OMR		
Part A Tamil Eligibility Test										
Part B (i) General Studies	Degree	75		150	135	180				
(ii) Aptitude and Mental Ability Test	SSLC	25								
Paper II Subject Paper	Degree / PG Degree	200	3 hours	300				CBT		
Total (Part B 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					
Name of the Post	Post Code	Subject Paper	Subject Code	Standard	Language of Question Paper
Agricultural Officer (Extension)	1678	Agriculture	284	Degree	English
Architectural Assistant/ Planning Assistant	2108	Town and Country Planning*	382	Post Graduate Degree / Degree	English
Assistant Curator (Archaeology)	1848	Archaeology	313	Degree	English
		Sanskrit	318		Sanskrit
Assistant Curator (Anthropology)	2130	Anthropology	417		English
		Zoology	270		Tamil and English
Assistant Curator (Zoology)	2131	Zoology	270		
Assistant Curator (Botany)	2132	Botany	268		English
		Geology	394		
Assistant Curator (National Art Gallery)	2133	History	315		Tamil and English

Assistant Curator (Pudukottai Government Museum)	3369	Sanskrit	318	Degree	Sanskrit
		Archaeology	313		English
		Geology	394		Tamil and English
		Zoology	270		
		Botany	268		
		History	315		
Assistant Director	1664	Chemical Engineering	405	Degree	English
		Electrical and Electronics Engineering	400		Tamil and English
		Textile Technology	406		
		Mechanical/ Manufacturing/ Production Engineering	399		
Assistant Engineer (Civil)	1656	Civil Engineering	398	Degree	Tamil and English
Assistant Engineer (Civil)	3656				
Assistant Engineer	1661				
Assistant Engineer (Civil)	3351				
Assistant Engineer (Civil)	3350				
Assistant Engineer	1660				
Assistant Engineer (Civil)	3232				
Assistant Engineer (Civil)	3368				
Assistant Engineer (Electrical)	1657	Electrical and Electronics Engineering	400	Degree	English
		Electronics and Communication Engineering	403		
Assistant Engineer (Electrical)	3487	Electrical and Electronics Engineering	400	Degree	English
		Electronics and Communication Engineering	403		
Assistant Engineer (Industries)	1900	Basics of Engineering	422	Degree	English
Assistant Geologist	1677	Geology	395	PG Degree	English
Assistant Geologist	1863				
Assistant Geologist	1750				
Assistant Tourist Officer, Grade II	3111	Travel and Tourism	353	Degree	English
Block Health Statistician	2010	Economics	416	Degree	Tamil and English
		Mathematics	419		
		Statistics	418		
Chemist	1913	Chemistry	244	PG Degree	Tamil and English
Chemist	3370	Chemistry	430	Degree	Tamil and English
Curator (Chemical Conservation)	2127	Chemistry	244	PG Degree	Tamil and English
		Chemical Technology	290		English
Curator	2129	Archaeology	314		English
		Anthropology	312		English
		Geology	395		Tamil and English
		Botany	269		
		Chemistry	244		
		History	317		
		Zoology	271		
		Sanskrit	319		Sanskrit

Deputy Manager (System)	3278	Computer Science and Engineering	407	Degree	English
		Information Technology	408		
		Computer Application	289	PG Degree	
		Computer Science	287		
Deputy Manager (Dairying)	3279	Dairy Science	458	PG Degree	English
		Food Technology / Food Processing	455	Degree	English
		Dairy Technology	456		
Deputy Manager (Quality Assurance)	3348	Chemistry	244	PG Degree	Tamil and English
		Dairy Science	458		English
		Bio Chemistry	460		
		Bio-Technology	461		
		Microbiology	459		
		Dairy Chemistry	468		
Drugs Inspector	1972	Pharmacy/ Pharmaceutical Sciences	429	Degree	English
		Clinical Pharmacology	352	PG Degree	
		Microbiology (Medicine)	351		
Foreman (Marine)	1762	Mechanical /Production / Manufacturing Engineering	399	Degree	Tamil and English
Junior Analyst	2006	Chemistry	430	Degree	Tamil and English
		Pharmacy/Pharmaceutical Sciences	429		English
Junior Architect	1860	Architecture	401	Degree	English
Junior Chemist	1914	Chemistry	244	PG Degree	Tamil and English
Assistant Librarian	1856	Library and Information Science	266	Degree	Tamil and English
Librarian Grade I	3347				
Library Assistant Grade I	1857				
Research Assistant	1861	Evaluation and Applied Research	213	PG Degree	English
Statistical Inspector	1697	Mathematics	419	Degree	Tamil and English
		Statistics	418		
Store Keeper	1768	Chemistry	430	Degree	Tamil and English
		Physics	241		
Junior Manager (Finance and Accounts)	3352	Financial and Cost Accountancy	433	Inter mediate	English
Assistant Manager	3349	Business Administration	385	PG Degree	Tamil and English
Secretarial Officer (Legal)	3372	Law	414	Degree	Tamil and English
Technical Executive (Mechanical)	3383	Mechanical / Production / Manufacturing Engineering	399	Degree	Tamil and English
Executive Surveyor	3384	Civil Engineering	398	Degree	Tamil and English
Executive Geologist	3385	Geology	394	Degree	English
X-Ray Analyst	3386	Chemistry	430	Degree	Tamil and English
CCR Operator	3387	Chemical Engineering	405	Degree	English

Assistant Warehouse Manager / Junior Assistant	3388	Agriculture	284	Degree	English
		Chemistry	430		Tamil and English
		Zoology	270		
		Botany	268		
*Town Planning (60% of questions- PG Degree Standard), Civil Engineering (25% of questions- Degree Standard) and Architecture (15% of questions- Degree Standard)					

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*		
Paper I	SSLC	100	3 hours	150	60	60	Objective	OMR
Part A Tamil Eligibility Test								
Part B (i) General Studies	Degree	75		150	135	180		
(ii) Aptitude and Mental Ability Test	SSLC	25						
Paper II Translation	Degree	-	3 hours	300			Descriptive	-
Total (Part B 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								

6.3. The Paper II and Part B 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 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 in the format prescribed in the para 6 of Annexure IV of this notification.

6.6. The syllabus for the written examination is available in Annexure III of this Notification.

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 / www.tnpsc.gov.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, date and time of physical certificate verification, and counselling on the Commission's website. 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. Any other communication with the Commission must be made through email to 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. Registration No.
- c. Name of the Candidate (in full and in block letters)
- d. Complete postal address as given in the application
- e. 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. Requests from candidates for furnishing of their marks or answer paper copy before the completion of the entire selection process, will not be entertained by the Commission.

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.

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.

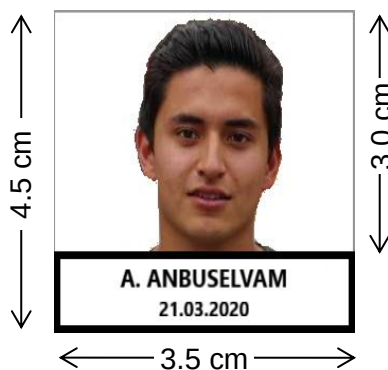
2.7.3. The Commission will not be responsible for any consequences arising out of failure on the part of the candidates to adhere to the instructions issued regarding One Time Registration or filling up of online application.

2.7.4. The instructions and illustration regarding One Time Registration are available on the website viz., www.tnpscexams.in.

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 20 KB–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. 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.

3.9.3. 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.

3.9.4. 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.

3.9.5. 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.

3.9.6. 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 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 post / these posts. 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 online application of the candidates who have not uploaded the required supporting documents (correctly / clearly / legibly) on or before the stipulated period shall be rejected after due process.

3.19.5. 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 / produce a copy of the First Information Report (FIR) or memorandum of charges / show cause notice, as the case may be. Failure to upload / produce 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 / produce 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 / produce 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 / producing 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.

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 ofinservice 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 / produce 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 / produce 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 / produce 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 / dependants 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. 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.

1.7. Fee Concession: Two free chances.

1.8. Reservation of Appointments: The rule of reservation of appointment to Ex-Servicemen is applicable only for the posts in Level- 9 to 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 particulars communal category.

1.9. Supporting Documents:

1.9.1. A candidate who claims to have been demobilised from the Army or Navy or Air Force needs to upload/produce either a 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 or 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

1.9.2. 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 / produce at the time of certificate verification, 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:

Signature of the Commanding Officer

Date:

1.9.3. Failure to upload/produce the supporting documents at the time of applying shall result in the rejection of candidature 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 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/ thumb impression
of the person in whose favour
certificate of disability is
issued.

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

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)

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 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

{Counter signature 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.

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	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 candidature after due process.

2.4.4. Claim as person with benchmark disability, unsupported by the prescribed documents shall result in rejection of candidature 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.4,000/-(Rupees Four 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 produce a certificate from the Revenue Divisional Officer or the Assistant Collector or the Sub-Collector concerned, in the format prescribed below. Failure to upload / produce such certificate or uploading / production of a widow or divorcee certificate at the time of online application shall result in rejection of candidature 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.:

Place:

Date:

Signature:

Name:

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 / produced 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 / produced.

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

4.2. Supporting Documents:

4.2.1. Candidates claiming to be Persons Studied in Tamil Medium (PSTM) must upload/produce 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.

4.2.2. Candidates must upload/produce documents as evidence of having studied in the Tamil medium, all educational qualifications from 1st standard up to the educational qualification prescribed.

4.2.3. If no such document as evidence for 'Person Studied in Tamil Medium' is available, a certificate from the Principal / Head Master / District Educational Officer / Chief Educational Officer / District Adi Dravidar Welfare Officer / Registrar / Controller of Examinations / Head / Director of the Educational Institution / Director / Joint Director of Technical Education/ Registrar of Universities as the case may be, in the format as shown below, must be uploaded / produced, for each and every educational qualification, from 1st standard upto the educational qualification prescribed.

4.2.4. Failure to upload/produce such documents as evidence for 'Persons Studied in Tamil Medium' for all educational qualification up to the educational qualification prescribed, at the submission of online application shall result in the rejection of candidature after due process.

4.2.5. Documents uploaded / produced as proof of having studied in Tamil medium, for the partial duration of any course / private appearance at any examination, shall not be accepted and shall result in the rejection of candidature after due process.

Certificate for having studied in Tamil Medium

This is to certify that Thiru./Tmt./Selvi.(Name) had studied Classes to with **Tamil as the medium of instruction**, during the year toand had satisfactorily completed the course of studies prescribed for Classes to

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 verifiable documentary evidence. The undersigned assumes full responsibility for the veracity of the contents herein.

Signature of Principal / Head Master /
District Educational Officer /
Chief Educational Officer /
District Adi Dravidar Welfare Officer

Place:

Date:

Seal of the Institution

Mobile No. _____

- If the candidate has studied in different schools from 1st std. up to 10th std./ 12th std., then the above certificate shall be obtained from each of the schools the candidate has studied in.

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 verifiable documentary evidence. The undersigned assumes full responsibility for the veracity of the contents herein.

Signature of Registrar / Principal / Controller of Examinations /
Head / Director of Educational Institution / Director/Joint
Director of Technical Education/ Registrar of Universities

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.

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/produce 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 / production of a community certificate citing name of the spouse, shall result in rejection of candidature 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'. However, Scheduled Caste converts to Sikhism and Buddhism shall be treated as Scheduled Castes.

5.6.8. Failure to upload / produce the supporting documents at the time of online application shall result in the rejection of candidature 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, Thozhuva 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 / production of a community certificate citing name of the spouse, shall result in rejection of candidature 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'.

6.5.7. Failure to upload / produce the supporting documents at the time of online application shall result in the rejection of candidature 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/produce 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 / production 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 candidature 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 / produce 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 / produce the same. Failure to upload / produce such a certificate shall result in rejection of candidature 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 / production of a Transgender ID card issued by the Tamil Nadu Transgender Welfare Board. Failure to upload / produce the same or uploading / production of a Transgender ID card issued by other authorities, shall result in rejection of candidature after due process.

Annexure III
Combined Technical Services Examination
Syllabus

Paper-I தமிழ் மொழி தகுதித் தேர்வு

பத்தாம் வகுப்பு தரம்

1. பிரித்தெழுதுதல் / சேர்த்தெழுதுதல்.
2. எதிர்ச்சொல்லை எடுத்தெழுதுதல்.
3. பொருந்தாச் சொல்லைக் கண்டறிதல்.
4. பிழை திருத்தம் (i) சந்திப்பிழையை நீக்குதல் (ii) மரபுப் பிழைகள், வழுவச் சொற்களை நீக்குதல் / பிறமொழிச் சொற்களை நீக்குதல்.
5. ஆங்கிலச் சொல்லுக்கு நேரான தமிழ்ச் சொல்லை அறிதல்.
6. ஒலி மற்றும் பொருள் வேறுபாடறிந்து சரியான பொருளையறிதல்.
7. ஒரு பொருள் தரும் பல சொற்கள்.
8. வேர்ச்சொல்லைத் தேர்வு செய்தல்.
9. வேர்ச்சொல்லைக் கொடுத்து / வினைமுற்று, வினையெச்சம், வினையாலணையும் பெயர், தொழிற் பெயரை / உருவாக்கல்.
10. அகர வரிசைப்படி சொற்களை சீர் செய்தல்.
11. சொற்களை ஒழுங்குப்படுத்தி சொற்றொடராக்குதல்.
12. இருவினைகளின் பொருள் வேறுபாடு அறிதல்.
(எ.கா.) குவிந்து-குவித்து
13. விடைக்கேற்ற வினாவைத் தேர்ந்தெடுத்தல்.
14. எவ்வகை வாக்கியம் எனக் கண்டெழுதுதல் - தன்வினை, பிறவினை, செய்வினை, செயப்பாட்டு வினை வாக்கியங்களைக் கண்டெழுதுதல்.
15. உவமையால் விளக்கப்பெறும் பொருத்தமான பொருளைத் தேர்ந்தெழுதுதல்
16. அலுவல் சார்ந்த சொற்கள் (கலைச் சொல்)
17. விடை வகைகள்.
18. பிறமொழிச் சொற்களுக்கு இணையான தமிழ்ச் சொற்களைக் கண்டறிதல் (எ.கா.) கோல்டு பிஸ்கட் - தங்கக் கட்டி.
19. ஊர்ப் பெயர்களின் மருஉ வை எழுதுக (எ.கா.) தஞ்சாவூர் - தஞ்சை
20. நிறுத்தற்குறிகளை அறிதல்.
21. பேச்சு வழக்கு, எழுத்து வழக்கு (வாரான் - வருகிறான்).
22. சொற்களை இணைத்து புதிய சொல் உருவாக்கல்.
23. பொருத்தமான காலம் அமைத்தல்
(இறந்தகாலம், நிகழ்காலம், எதிர்காலம்).
24. சரியான வினாச் சொல்லைத் தேர்ந்தெடு.
25. சரியான இணைப்புச் சொல்
(எனவே, ஏனெனில், ஆகையால், அதனால், அதுபோல).
26. அடைப்புக்குள் உள்ள சொல்லைத் தகுந்த இடத்தில் சேர்க்க.
27. இருபொருள் தருக.

28. குறில் - நெடில் மாற்றம், பொருள் வேறுபாடு.
29. கூற்று, காரணம் - சரியா? தவறா?
30. கலைச் சொற்களை அறிதல்:-
எ.கா. - Artificial Intelligence - செயற்கை நுண்ணறிவு
Super Computer - மீத்திறன் கணினி
31. பொருத்தமான பொருளைத் தெரிவு செய்தல்
32. சொற்களின் கூட்டுப் பெயர்கள் (எ.கா.) புல் - புற்கள்
33. சரியான தொடரைத் தேர்ந்தெடுத்தல்
34. பிழை திருத்துதல் (ஒரு-ஓர்)
35. சொல் - பொருள் - பொருத்துதல்
36. ஒருமை-பன்மை பிழை
37. பத்தியிலிருந்து வினாவிற்கான சரியான விடையைத் தேர்ந்தெடு.

GENERAL STUDIES (Degree Standard)

CODE: 003

Unit I: General Science

- (i) Scientific Knowledge and Scientific Temper - Power of Reasoning - Rote Learning vs Conceptual Learning - Science as a tool to understand the past, present and future.
- (ii) 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.
- (iii) Elements and Compounds, Acids, Bases, Salts, Petroleum Products, Fertilisers, Pesticides.
- (iv) Main concepts of Life Science, Classification of Living Organisms, Evolution, Genetics, Physiology, Nutrition, Health and Hygiene, Human Diseases.
- (v) Environment and Ecology.

Unit II: Current Events

- (i) History - Latest diary of events - National symbols - Profile of States - Eminent personalities and places in news - Sports - Books and authors.
- (ii) Polity - Political parties and political system in India - Public awareness and General administration - Welfare oriented Government schemes and their utility, Problems in Public Delivery Systems.
- (iii) Geography - Geographical landmarks.
- (iv) Economics - Current socio - economic issues.
- (v) Science - Latest inventions in Science and Technology.
- (vi) Prominent Personalities in various spheres - Arts, Science, Literature and Philosophy.

Unit III: Geography of India

- (i) Location - Physical features - Monsoon, Rainfall, Weather and Climate - Water Resources - Rivers in India - Soil, Minerals and Natural Resources - Forest and Wildlife - Agricultural pattern.
- (ii) Transport - Communication.
- (iii) Social Geography - Population density and distribution - Racial, Linguistic Groups and Major Tribes.
- (iv) Natural calamity - Disaster Management - Environmental pollution: Reasons and preventive measures - Climate change - Green energy.

Unit IV: History and Culture of India

- (i) Indus Valley Civilization - Guptas, Delhi Sultans, Mughals and Marathas - Age of Vijayanagaram and Bahmani Kingdoms - South Indian History.
- (ii) Change and Continuity in the Socio-Cultural History of India.
- (iii) Characteristics of Indian Culture, Unity in Diversity – Race, Language, Custom.
- (iv) India as a Secular State, Social Harmony.

Unit V: Indian Polity

- (i) Constitution of India - Preamble to the Constitution - Salient features of the Constitution - Union, State and Union Territory.
- (ii) Citizenship, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy.
- (iii) Union Executive, Union Legislature – State Executive, State Legislature – Local Governments, Panchayat Raj.
- (iv) Spirit of Federalism: Centre - State Relationships.
- (v) Election - Judiciary in India – Rule of Law.
- (vi) Corruption in Public Life – Anti-corruption measures – Lokpal and Lok Ayukta - Right to Information - Empowerment of Women - Consumer Protection Forums, Human Rights Charter.

Unit VI: Indian Economy

- (i) Nature of Indian Economy – Five year plan models - an assessment – Planning Commission and Niti Ayog.
- (ii) 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.
- (iii) 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.

Unit VII: Indian National Movement

- (i) 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.
- (ii) Different modes of Agitation: Growth of Satyagraha and Militant Movements.
- (iii) Communalism and Partition.

Unit VIII: History, Culture, Heritage and Socio - Political Movements in Tamil Nadu

- (i) History of Tamil Society, related Archaeological discoveries, Tamil Literature from Sangam Age till contemporary times.
- (ii) Thirukkural :
 - (a) Significance as a Secular Literature
 - (b) Relevance to Everyday Life
 - (c) Impact of Thirukkural on Humanity
 - (d) Thirukkural and Universal Values - Equality, Humanism, etc
 - (e) Relevance to Socio-Politico-Economic affairs
 - (f) Philosophical content in Thirukkural
- (iii) Role of Tamil Nadu in freedom struggle - Early agitations against British Rule - Role of women in freedom struggle.
- (iv) 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.

Unit IX: Development Administration in Tamil Nadu

- (i) 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.
- (ii) Political parties and Welfare schemes for various sections of people – Rationale behind Reservation Policy and access to Social Resources - Economic trends in Tamil Nadu – Role and impact of social welfare schemes in the Socio - Economic Development of Tamil Nadu.
- (iii) Social Justice and Social Harmony as the Cornerstones of Socio- Economic Development.
- (iv) Education and Health Systems in Tamil Nadu.
- (v) Geography of Tamil Nadu and its impact on Economic growth.
- (vi) Achievements of Tamil Nadu in various fields.
- (vii) e-Governance in Tamil Nadu.

Unit X: Aptitude and Mental Ability

- (i) Simplification – Percentage - Highest Common Factor (HCF) - Lowest Common Multiple (LCM).
- (ii) Ratio and Proportion.
- (iii) Simple interest - Compound interest - Area - Volume - Time and Work.
- (iv) Logical Reasoning - Puzzles-Dice - Visual Reasoning - Alpha numeric Reasoning – Number Series.

Syllabus

Paper II – Subject Paper

1. AGRICULTURE (Degree Standard)

CODE: 284

UNIT I: IMPORTANCE OF AGRICULTURE

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 AYOOG – import and export – role of NSC, FCI and PDS.

UNIT II: FUNDAMENTALS OF CROP PRODUCTION

Factors of Production - Agricultural seasons of India and Tamil Nadu - Cropping patterns in India and Tamil Nadu - package of practices of different crops - AgroClimatic zones of India and Tamil Nadu and their features - Weather and Climate - Weather forecasting - Climate change and its impact – Minimal tillage practices – Stress mitigating technologies including microorganisms – Nanoparticles and their applications.

UNIT III: NATURAL RESOURCE MANAGEMENT

Soil - Soil structure - Factors influencing soil structure - Physical and Chemical properties - Effect of nutrient availability and plant growth - Problem soils and their management - Soil survey - its objectives and scope - Soil fertility and productivity - 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

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 Irrigation management of different crops Mushroom cultivation, bee keeping, silk work 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

Principles of breeding - Breeding methods in self, cross and vegetatively propagated crops - Modern tools in crop improvement – Heterosis breeding and Hybrid seed production technologies - Latest varieties of major crops in Tamil Nadu - Breeding for Climate resilience varieties – Variety release procedures - Application of bio technology in Agriculture - Tissue culture & its significance - Transgenic Plants. Plant Genetic Resources: Collection conservation and exchange-Crop varietal protection-PPV& FR authority and its role.

UNIT VI: SEED SCIENCE AND TECHNOLOGY

Seeds - Importance of quality seeds in Agriculture – Nucleus, Breeder, foundation, certified and labelled 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.

UNIT VII: CROP PROTECTION PRINCIPLES AND PRACTICES

Importance of pest, disease, nematodes and weed management in agriculture – categories of pests, diseases, nematodes and weeds - pest and disease surveillance and forecasting weather on pest and disease incidence - Symptoms of damages 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.

UNIT VIII: FARM BUSINESS AND FINANCE MANAGEMENT

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-3 Rs,5Cs and 7Ps of credit-Crop Insurance - Kisan Credit Cards (KCC) - Agricultural Insurance Company.

UNIT IX: AGRICULTURAL MARKETING AND MARKET INTELLIGENCE

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 – 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 - 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

Extension methods for transfer of technology - AV aids-Communication models - Use of ICT in transfer of technology-Diffusion and adoption- Pre and post-independence 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.

2. ARCHITECTURE (Degree Standard)

CODE: 401

UNIT I: INTRODUCTION TO ARCHITECTURE

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

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

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 SYSTEMS AND SERVICES – CURRENT DEVELOPMENT & NEW TRENDS

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

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 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

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

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

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

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. Note: Medium of Instruction is English only.

3. CIVIL ENGINEERING (Degree Standard)

CODE: 398

UNIT I: BUILDING MATERIALS AND CONSTRUCTION PRACTICES

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

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

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

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

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

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

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

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

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

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.

4. ARCHAEOLOGY (Degree Standard)

CODE: 313

UNIT I: HISTORY OF TAMIL NADU

Importance of Archaeology – Contributions of Sangam Age, Pallavas, Cholas, Cheras, Pandyas – Religion - Society - material life - Monuments of Pallavas – Cholas – Pandyas – Vijaya Nagaras – Nayak.

UNIT II: HISTORY OF ARCHAEOLOGY

Definition - Development of Archaeology in India – Asiatic Society – 20th century - Kinds of Archaeology - Robert Bruce Foote – Mortimer Wheeler – Relation between History and Archaeology.

UNIT III: FIELD ARCHAEOLOGY

Exploration techniques – Exploration tools – Excavation methods – Equipments - Staffs – Documentation and Interpretation – Preparation of Excavation Report – Dating methods.

UNIT IV: PRE AND PROTO HISTORY OF INDIA

History of Indian Prehistory – Relation between Prehistory and Geology – Lower, Middle and Upper Palaeolithic periods – Mesolithic period – its distribution – Neolithic period – its distribution – Stone tool industries - Salient features of : Chalcolithic culture, Harappan culture and Iron Age culture – burial types in Tamil Nadu.

UNIT V: EPIGRAPHY AND PALAEOGRAPHY

Importance of Epigraphy – Development of Epigraphical studies in Tamil Nadu – Origin and development of Tamil-Brahmi – Vatteluttu – Grantha script – Hero stone inscriptions – Pullimankombai and Mangulam inscriptions – Velvikudi Copper plates – Uttiramerur inscription.

UNIT VI: NUMISMATICS

Importance of Numismatics – Punch marked coins – Coins of Indo-Greeks – Gupta coins – Sangam coinage – Pallava coins – Chola coins – Vijayanagara coins – Symbols and Legends.

UNIT VII: ART AND ARCHITECTURE

Harappan Art – Mauryan Art and Architecture – Stupa and Chaitya and Vihara architecture – Monolithic and Structural temples of Tamil Nadu - Rock cuts of Early Pandyas and Pallavas – Temples at Mamallapuram, Vettuvankoil, Kanchipuram, Thanjavur, Gangaikonda Cholapuram.

UNIT VIII: ICONOGRAPHY AND PAINTING

Mudras – Asanas – Vahanas - Saiva Iconography – Vaishnava Iconography – Ornaments – Pallava and Pandya paintings – Chola paintings - Nayak paintings.

UNIT IX: MUSEOLOGY

Origin Museum in India - Museum types – Display Methods – Documentation - Establishment - Legal aspects relating to conservation and preservation.

UNIT X: EARLY HISTORICAL ARCHAEOLOGY

Importance of early historical archaeology – Important Excavations: Kodumanal, Arikamedu, Kaveripumpattinam and Keeladi – Excavations at Kausambi, Lothal and Dolavira – Contributions of Archaeological Survey of India, State Department of Archaeology and University Departments: University of Madras and Tamil University.

5. BOTANY (Degree Standard)

CODE: 268

UNIT I: PHYCOLOGY, MYCOLOGY & LICHENOLOGY

Phycology - Fritsch's classification of Algae - pigmentation - Thallus organization - Life cycles- patterns of Algae - Evolutionary trends in the Sexuality of Algae - Economic importance - Algae as food, fodder, fertilizer and medicines - phytoplanktons and their role. Mycology - Classification of fungi (Alexopoulos and Mims 1979) - structure, reproduction and economic importance of Phycomycetes, Ascomycetes, Basidiomycetes and Deuteromycetes. Lichenology - structure, reproduction and economic importance of lichens.

UNIT II: BRYOLOGY AND PTERIDOLOGY

Byrophytes - General characteristics, structure; reproduction and alternation of generations. Pteridophytes - General characteristics - Psilopsida, Lycopsidea, Sphenopsida and Pteropsida - Stelar organisation - origin of heterospory and seed habit.

UNIT III: GYMNASPERMS AND PALEOBOTANY

A comparative account of vegetative and reproductive structure of Cycadales, Coniferales and Gnetales - Structure of wood in Gymnosperm - Economic importance of Gymnosperms – Paleobotany, Geological Time Scale - Fossilization methods - Fossil types.

UNIT IV: ANGIOSPERM MORPHOLOGY, TAXONOMY AND ECONOMIC BOTANY

Root and Stem modification in relation to habitat. Inflorescence: Raceme, Cyme and Special types Pollination – Types, Agents (Biotic and Abiotic) and contrivances promoting cross pollination. Taxonomy - Angiosperm Classification - Bentham and Hooker's system - International code of Botanical Nomenclature (outline). Characteristics features and Economic importance of the following families:- 1) Magnoliaceae 2) Rutaceae 3) Anacardiaceae 4) Leguminosae 5) Asteraceae 6) Apiaceae 7) Euphorbiaceae 8) Arecaceae 9) Poaceae Economic Botany of Plants yielding wood timber, fibre, oil and medicines.

UNIT V: ANATOMY AND EMBRYOLOGY

Anatomy:- Meristems and types. Permanent tissues, Simple and Complex tissues - Normal and Abnormal secondary thickening. Embryology:- Microsporogenesis, Megasporogenesis - types of embryo sacs (Mono-biand tetrasporic). Double fertilization and Triple fusion, Types of Endosperm - Embryo development in Dicots and Monocots. Apomixis and Polyembryony Culture techniques - anther and embryo.

UNIT VI: GENERAL MICROBIOLOGY AND PLANT PATHOLOGY

Morphology, reproduction and economic importance of Bacteria. Viruses - Bacteriophages, Cyanophages, Mycophages, their general structures and multiplication. Mycoplasma - Structure. Fermentation and Antibiotic production. Plant Pathology:- Name of the causative organism, etiology and control measures of the following plant diseases. 1) Blast of Paddy 2) Wilt of Cotton 3) Citrus Canker 4) Powdery Mildew 5) Red rot of Sugarcane 6) Little leaf of Brinjal 7) Bunch Top of Banana 8) Early and late Blights of Potato 9) Rust and Smut diseases.

UNIT VII: PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS

Physiology:- Water relations of plants - absorption and translocation of water and minerals - mineral nutrition - Photosynthesis, Photochemical reactions and carbon fixation pathways – Respiratory metabolism: aerobic and anaerobic respiration. **Enzymes:** Role as biocatalysts - Nitrogen Metabolism: Nitrogen cycle - Nitrogen fixation - Nitrate reduction. Plant growth substances chemical nature and physiological functions of auxins, gibberellins, cytokinins, ethylene, abscissic acid and Brassinosteroids. **Biochemistry and Biophysics** Biopolymers: A brief account of Carbohydrates, Lipids, Proteins and Nucleic acids and their monomers. An elementary account of thermodynamics - definition of energy - structure and role of ATP.

UNIT VIII: CYTOLOGY, GENETICS AND EVOLUTION

Cytology: Organization of Prokaryotic and Eukaryotic cells. Cell organelles - structure and function. Chromosomes: morphology structure and their role. Cell division: Mitosis and Meiosis. **Genetics:** Mendelism - Interaction factors - linkage and crossing over, multiple, alleles, mutation, structure, replication and role of nucleic acids. **Evolution:** Origin of life: Theories of evolution Darwin, Lamarck and De Vries.

UNIT IX: ECOLOGY, ENVIRONMENT AND CONSERVATION BIOLOGY

Ecology: Ecosystem concept - Plant communities: Hydrophytes, Xerophytes, Mangroves. Plant succession primary and secondary - Climax formation. **Environment:** water, air and land, Garbage disposal, Environmental Protection Agencies, Pollution monitoring and control. **Ecosystem:** Components and functions – Global warming, Green house effect, Ozone Layer Depletion **Conservation Biology:** Conservation and sustainable development/ Productivity of Soil, forests and natural resources.

UNIT X: HORTICULTURE AND PLANT BREEDING

Horticulture: Importance and scope of Horticulture, Classification of Horticultural Plants - Fruits, Vegetables and Ornamentals. Garden design and types:- Rockery, Bonsai, Kitchen garden, Lawn making, Floriculture. Cultivation of Commercial Flowers – Jasmine; plant propagation methods - cutting, grafting, layering (Rose) budding, stock - scion relations in Mango, **Plant Breeding:** Hybridization techniques Plant breeding methods employed in the following crops:- 1) Cotton 2) Sugarcane 3) Paddy.

6. ZOOLOGY (Degree Standard)

CODE: 270

UNIT I: Non-Chordata

General organisation - Classification with diagnostic features upto classes. Evolutionary relationship among taxa, symmetry. Protozoa: Structure, reproduction and life history of Amoeba, Paramecium, Trypanosoma, Plasmodium, Monocystis, Leishmania - locomotion, nutrition, economic importance. Porifera: Sponges canal system, skeleton, reproduction and economic importance. Coelenterata: Diploblastic organization - life history of Obelia and Aurelia, Metagenesis - Polymorphism in Hydrozoa. Corals and Coral formation - relationships of Cnidaria and Acnidaria. Helminthes: Structure and life history of Planaria, Fasciola, Teania, Ascaris and Wuchereria - parasitic adaptations - Helminthes in relation to man. Annelida: Nereis, earthworm and leech - Coelom and metamerism - modes of life in polychaetes. Onychophora: Structure, affinities and distribution of Peripatus. Arthropoda: Prawn, Scorpion and Cockroach - Larval forms and parasitism in Crustacea - Mouth parts, vision, respiration and excretion. Metamorphosis and social life in insects. Mollusca: Freshwater mussel, pila, sepia. Echinodermata: General organisation - Water vascular system. Larval forms and affinities.

UNIT II: Prochordata

Amphioxus, Balanoglossus - Ascidian retrogressive Metamorphosis, neoteny and affinities. Chordata: General Organisation - Characters, Outline, classification upto class level. Pisces: Locomotion, migration,

respiration, Parental care, economic importance; structure and affinities of dipnoi. Amphibia: Origin of amphibians – Respiration, Parental care - South Indian amphibians. Reptiles: Origin - Conquest of land - adaptations to live on land, adaptive radiation - Temporal Vacuities - identification of poisonous and non-poisonous snakes - poison apparatus – South Indian snakes. Birds: Origin - flight adaptations - mechanism of flight - double respiration - migration - Flightless birds. Mammals: Dentition, skin derivatives - distribution - adaptive radiation. Protothria, Metatheria, eutheria and their Phylogenetic relationships.

UNIT III: Cell and Molecular Biology

Cellular Organelles - Structure and function - Plasma membrane, Mitochondria, Golgi bodies, Endoplasmic reticulum and Ribosomes – Nucleus and Nucleolus. Cell division, cell cycle; Chromosomes - DNA structure and function, replication of DNA, Genetic code - RNA and protein synthesis. Gene expression, regulation of gene expression in prokaryotes and Eukaryotes. Recombinant DNA - Genetic engineering, its uses in agriculture, industries and medicine.

UNIT IV: Genetics

Mendelian concepts, multiple alleles, blood groups, Rh-factor. Linkage, crossing over - mutation (Natural and induced); Sex chromosomes, Sex determination and Sex Linked inheritance - Chromosome number and form ploidy - cytoplasmic inheritance – Karyo types – chromosome mapping, Normal and abnormal genetic disorders; Bio-chemical genetics – Eugenics. Human genome Project. Bio-statistics: Mean, Median and standard deviation. Bio-informatics: DNA and Protein sequence analysis, Prediction functional structure, protein folding, Phylogenetic tree construction.

UNIT V: Bio Chemistry

Bio-molecules, Structure and role of carbohydrates, lipids, proteins and amino acids - Glycolysis and kreb's cycle - oxidation, reduction - oxidative phosphorylation - energy conservation and release, cyclic AMP, ATP; enzymes – mechanism; Hormones-classification biosynthesis and function. Physiology: With reference to mammals, digestion, nutrition, balanced diet - assimilation, intermediary/metabolism. Composition of blood - Coagulation, Transport of oxygen, Carbon dioxide, Blood pigments, Mechanism of respiration. Muscles, mechanism of muscle contraction. Temperature regulation, Acid base balance and homeostasis, Nerve impulses and conduction, neurotransmitters. Receptors- photo, phono and chemo reception. Nephron and urine formation. Endocrine glands, testis, ovary and pituitary organs and their inter relationship. Physiology of reproduction in humans, Hormonal development in insects, pheromones and their uses. Bioluminescence. Biological clock. Physiology of immune response- Antigens – Immuno globulins - humoral and cell mediated immunity. T and B cells, mechanism of antibody formation - Immunodeficiency diseases; vaccination.

UNIT VI: Development Biology

Gametogenesis – fertilization, Pathenogenesis, type of eggs – blastulation, cleavage and gastrulation in frog and chick. Morphogenetic movements – organizer, potency, organogenesis with reference to ear, eye, kidney, brain. Formation and fate of extra embryonic membranes in chick. Placentation- types, functions. - metamorphosis in Frog – Regeneration. Stem cellssources, types and their uses in human welfare, IVF, embryo transfer and cloning - Aging and senescence.

UNIT VII: Environmental Biology

Biotic and abiotic factors, their role, Intra and inter specific association. Biogeochemical cycles. Ecosystem- structure and function of ecosystems, types of ecosystems. Ecological succession, Community structure - Stratification. Population and Population dynamic - Habitat ecology. Wild life, need for conservation management and methods of conservation. Sanctuaries with special reference to Tamil Nadu. Pollution - air, water and land - Perspective policy planning for the environment.

UNIT VIII: Evolution

Origin of life - Evolutionary theories - Contributions of Lamarck, Darwin and De Vries - present status of Darwinism and Lamarkism - modern synthetic concept - Hardy Weinberg Law - Polymorphism and mimicry in evolution. Speciation: evolutionary species concept – Isolation, mechanisms and their role, role of hybridization in evolution. Fossils and Fossilization, Indian fossils, Geological time scale. Origin and evolution of horse and man - Culture evolution and Biochemical evolution. Animal distribution: Zoogeographical distribution - Continental and island fauna - Continental drift - Discontinuous distribution, adaptive radiation. Natural resources and their conservation. Alternative sources of energy.

UNIT IX: Economic Zoology

Parasitism and Commensalism - Protozoan Parasites and diseases, helminthes parasites and diseases of man and domestic animals; Beneficial and harmful insects. Insect pests on crops and stored products - Control methods. IPM. Sericulture, apiculture, lac culture, seaweed culture, vermiculture, - oyster culture and pearl formation, poultry, pisciculture and induced breeding, Shell fisheries, Aquaculture practices in Tamil Nadu and their impact on the environment and on agriculture.

UNIT X: Instrumentation and Bio-techniques

Microscopy-Phase contrast, fluorescent, TEM, SEM. Colorimetric techniques, Centrifugation techniques. Fixation, staining techniques. Electrophoretic techniques: Principles, AGE and PAGE. DNA finger printing, RFLP, RAPD and AFLP.

7. ANTHROPOLOGY (Degree Standard)

CODE: 417

UNIT I: INTRODUCTION

Anthropology - Origin and History; Meaning and Definitions; Uniqueness and approaches - Holistic, Comparative, Integrative, Cross-Cultural, Human Friendly and Relativistic, etc; Scope and Utility; Subfields / Branches – Physical / Biological Anthropology, Archaeological / Prehistoric Anthropology, Social – Cultural Anthropology and Linguistics Anthropology; Relationship of Anthropology with Sociology, Psychology, Archaeology, History, Economics, Geography and Politics. Indian Anthropology.

UNIT II: HUMAN BIOLOGY AND VARIATION

Emergence and dispersal of Homo sapiens-Characteristic and geographical distribution of early humans; Theories of human origin and Evolution; Position of Human in the Animal kingdom; Stages of Human Evolution; Adaptation and change; Race and Ethnicity; Peopling and People of India.

UNIT III: FOUNDATIONS OF SOCIETY AND CULTURE

Society - Characteristics and Types; Individual and Society; Status and Role; Groups, Association, Community, Institution, Social Structure, Socialization, Social Organization, Social System and Social stratification; Society in India. Culture - Elements, Culture and Civilization; Material and Non-material Culture; Cultural trait, Culture complex, Culture area, Cultural diversity and Multiculturalism; Ethnocentrism, Egalitarianism, Enculturation, Acculturation, Cultural Lag and Culture Shock; Culture of India. Social and Cultural Change-Diffusion, Assimilation, Integration, Innovation, Syncretism, Dominance, and Subjugation. Institution and Organization - Meaning and Definition.

UNIT IV: MARRIAGE, FAMILY AND KINSHIP

Marriage - Definition, Universal Definition of Marriage; Nature, Functions, and Forms of Marriage; Rules of Marriage, Incest Taboo; Ways of acquiring mates, Marriage Payments: Bride Price, Bride Wealth, and Dowry; Divorce; widowhood and remarriage; Marriage systems in India. Family-Definition, Functions, and Universality of Family; Types and classification of Family; Nature of Family in India; Household vs Family;

Lineage, Clan, Phratry, Moiety; Right – de-passage; Ritual, Myth, Folklore. Kinship-Definition, Terminology, and Types of Kinship; Kinship Behaviour - Avoidance, Joking Relationship Teknonymy, Avunculate, Animate and Couvade; Descent and Descent groups; Importance of Kinship; Kinship system in India. Social and Cultural Change-Global and Indian context.

UNIT V: RELIGION, MAGIC AND SCIENCE

Religion - History, Meaning and definition; Theories and Forms of Religion – Animism, Animatism, Fetishism, Ancestor Worship, Nature Worship, Zoomorphism, Anthropomorphism, Totemism, Polytheism and Monotheism; Oral Religion and Religion with books. Concept of Magic: Meaning and definitions; Elements of Magic; Forms and Types of Magic. Science – Meaning and definition; Elements and Features; Relevance of Science. Relationship between Religion, Magic and Science.

UNIT VI: ECONOMIC ORGANISATION

Economic Organisation-Meaning and definition; Key Concepts-Production, Distribution, Re-distribution and Consumption; Concept of Property and Wealth; Division of labour; Types of Traditional Economic Organizations – Hunting and Gathering, Fishing, Shifting Cultivation, Pastoralism, Agriculture; Forms of Exchanges – Ceremonial, Ritual etc.

UNIT VII: POLITICAL ORGANIZATION

Political Organisation - Meaning and Definitions; Concept of Power, Leadership and Authority; Law, Conflicts and Social Control; Concept of Crime and Punishment; Typology of Political Systems – Band, Chiefdom, Big-man, Tribe, State.

UNIT VIII: TRIBE, RURAL AND URBAN SOCITIES

Tribe - Meaning and Definition; Characteristics, Classification and Distribution in India; Tribal Administration and Constitutional safeguards; Tribal Development, Problems and Tribal movements in India; Tribal Communities of Tamil Nadu. Rural or Village Society-Community, Peasant and their Significance; Structure and Function of Indian Village; Significance of Caste & Class System in India; Agrarian and Peasant movements in India. Panchayat Raj, Social Change and Impact of Market/Industrial Economy on Indian Villages. Urban and Complex Society - Meaning and characteristics; Urbanism and Urbanisation; Folk – Urban – Continuum; Urban problems-Migration, Poverty, Culture of Poverty, Study on Slum, Study on Beggars, Drug, Alcoholism, Environmental degradation, Pollution and Health issues; Development and Globalisation in Indian Context.

UNIT IX: APPLIED ANTHROPOLOGY

Applied Anthropology - Definition and Scope; Application-Teaching, Research, Administration, Governance, Planning and Development; Social Engineering and Social Doctor; Action, Advocacy and Public Anthropology; Utility in various other fields-Global, National, Local, and Domestic.

UNIT X: RESEARCH AND PRACTICING ANTHROPOLOGY

Research - Meaning, Definition, Objectives and Characteristics; Significance of research; Scientific Research; Qualitative and Quantitative Research; Research Methodology-Methods, Techniques, Tools, and Instruments; Fieldwork and Ethnography; Types of Research; Pilot study and Research Design; Steps involved in Research process. Practicing Anthropology-Applied, Advocacy, Action and Public Anthropology.

8. HISTORY (Degree Standard)

CODE: 315

UNIT I: INDIA – PRE-HISTORIC AND EARLY HISTORIC INDIA

Physical features - Cultural pluralism - Unity in Diversity - Indus Valley Civilization – Vedic Age - Jainism – Buddhism.

UNIT II: ANCIENT POLITY

Pre Mauryan India - The Mahajanapadas - Persian and Alexander's invasion - Its effects - Rise of Maghada - The Mauryan Empire - Asoka Wars - Asoka's Dhamma - Mauryan Administration - Kushans - Kanishka - The Guptas - Golden Age - The Kushabhutis - Harshavardhana - Career - Services to Buddhism.

UNIT III: ANCIENT AND MEDIEVAL TAMIL CULTURE

Sangam Age - Social, economic, religious and cultural conditions - The Kalabharas - Identity and services to Tamil culture - The Pallavas - Their contribution to Art and Architecture - The First dynasty of the Pandyas of Madurai - The Imperial Cholas - Their administration - Growth of religion and culture - Second Pandyan Kingdom - Religion and culture - Spread of Tamil culture abroad.

UNIT IV: EMERGING MIGHT OF ISLAM

Muslim invasions: Muhammad Ghazni and Muhammad Ghor - Sultans of Delhi - QutbUd-din-Aibek to Balban - Alauddin Khilji - Administration - Muhammad bin - Tughlaq - Feroz Tughlaq - Social and Religious condition under the Sultanate.

UNIT V: MEDIEVAL DECCAN

Bahmani Kingdom - Vijayanagar Kingdom - Krishna Devaraya - Their contributions to Art and Architecture, religion and literature - Bhakti cult.

UNIT VI: THE GREATER MUGHALS

Babur - Humayun - Shershah - Akbar to Aurangzeb - Mughal Administration - Art and Architecture under the Mughals. Shivaji - His administration - The Sikhs.

UNIT VII: LAYING THE FOUNDATION OF THE BRITISH RULE IN INDIA

Coming of the Europeans - British East India Company - Anglo - French rivalry - Robert Clive to Dalhousie - Wars - Reforms - Administration.

UNIT VIII: INDIA'S STRUGGLE FOR FREEDOM

i) Early Resistance to the British - Tamil Nadu as forerunner - Poligar uprising - Puli Tevan - Veera Pandia Kattabomman - South Indian Rebellion (1800-1801) - Vellore Mutiny (1806) - Friction in the North - Sepoy Mutiny (1857) - Results. ii) National Awakening and the Road to Freedom - Queen's Proclamation - Causes for the birth of nationalism - Socio - religious Reform Movements in the 19th and 20th Centuries - with special reference of Tamil Nadu - Indian National Congress - Early phase - (1885-1916) - Moderates and the Extremists - Gandhian Era (1915-1948) - Various movements - Role of Tamil Nadu in the Freedom struggle - Role of Muslim and Christian minorities in the struggle - Social Justice in Tamil Nadu - Role of E.V.Ramasamy - Justice Party and social reforms - Temple entry movement - Devadasi abolition - Upper garment agitation.

UNIT IX: CONSTITUTIONAL DEVELOPMENT

Regulating Act 1773 - Pitt's India Act 1784 - Acts of 1858, 1909, 1919, 1935 and 1947 - Salient features of Indian Constitution.

UNIT X: IMPACT OF THE BRITISH RULE ON INDIA

Integration of Indian States - State reorganization, Planning Commission - India's Foreign policy - Education in India since Independence - Human Rights in India - Tamil Nadu since 1947 - Congress governments and development - Dravidian Party Governments and Social welfare since 1968.

9. SANSKRIT
(Degree Standard)

CODE: 318

UNIT I: POETRY (MAHAKAVYA) Raghuvamsam Canto I, R.S. Vadhyars Sons Palaghat II

UNIT II: PROSE (GADYAKAVYAM) Sukanase, Upadesa of Kadambari, Sangraha by R.V. Krishnamacharia, Chennai.

UNIT III: DRAMA (NATAKAM) Pancharathra of Bhasa R.S.V. & Sons, Palaghat

UNIT IV: EROTIC-LYRICS Meghadutam by Kalidasa, Motilal-Banarasidoss, Chennai - 4.

UNIT V: DEVOTIONAL LYRIC Krishna Karnamrutam by Leela suka, Lifco, Chennai-17

UNIT VI: ETHICAL AND GNOMIC Neeti Satakam of Bharatruhari: Motilal Banarasidoss, Chennai-4

UNIT VII: ALANKARAS Chandraloka, Vth Mayukha, Ghowkhambe, Sanskrit services, Varanasi.

UNIT VIII: GRAMMAR (SANDHI, SAMASA VIBHAKTI (AJANTHA PULLINGA TO HALANTA PULLINGA) AND KARAKA) LaghuSiddhanta Kaumudi Ghowkhambha Sanskrit Series.

UNIT IX: TRANSLATION Sanskrit to English and English to Sanskrit (simple sentences).

UNIT X: HISTORY OF SANSKRIT LITERATURE History of Sanskrit, Literature by T.K. Ramachandra Iyer, R.S.V & Sons, Palaghat.

10. GEOLOGY
(Degree Standard)

CODE: 394

UNIT I: GENERAL GEOLOGY

Solar System - Origin, Interior and Age of the Earth - Weathering - Types and products - Geological work of Wind, River, Sea and Groundwater - causes and effects of Volcanoes and Earthquakes - Seismic zonation - Richter Scale - Principles of Plate Tectonics - Island arcs, deep sea trenches and mid-ocean ridges - Continental drift evidences and mechanics - Sea floor spreading - Isostasy, Orogeny and Epeirogeny - Continents and oceans – Fundamental of Geomorphology.

UNIT II: STRATIGRAPHY

Principles of Stratigraphy, code of stratigraphic nomenclature, lithostratigraphy, biostratigraphy, chronostratigraphy, Correlation – Geological Time Scale - Distribution and classification of Precambrian - Dharwar and Proterozoic rocks - Cuddapah and Vindhyan of India - Study of stratigraphic successions, lithology, fauna, flora and economic importance of Phanerozoic rocks of India - Triassic of Spiti, Jurassic of Kutch, Gondwana and Cretaceous of Tiruchirappalli erstwhile Trichinopoly, Tertiary of Assam - Major boundary problems – Cambrian/ Precambrian and Cretaceous/ Tertiary - Tectonic framework of India - Evolution of the Himalayas.

UNIT III: STRUCTURAL GEOLOGY

Stress and Strain - Stress strain relationship of elastic, plastic and viscous materials – Planar and linear structures – Shear Zones - Description and classification of Folds – Faults – Joints – Unconformities – Recognition of overturned beds – Attitude of beds – Measurement of dip, apparent dip, strike using Clino and Brunton compass.

UNIT IV: PALEONTOLOGY

Species – definition and nomenclature - Megafossils and Microfossils - Modes of preservation of fossils - Different kinds of microfossils - Application of microfossils in correlation, petroleum exploration, paleoclimatic and paleoceanographic studies - Morphology, Classification, evolutionary trends and geological history of Coelenterata, Brachiopoda, Cephalopoda, Echinoids, Trilobita, Graptolites and Foraminifera - Stratigraphic utility of Ammonoidea, Trilobita and Graptoloidea - Evolutionary trends in Hominidae, Equidae and Proboscidae - Siwalik fauna - Gondwana flora and its geological and paleoclimatic importance.

UNIT V: CRYSTALLOGRAPHY

Definition of Crystals – Classification - Inter facial angles – Goniometer - Symmetry - Symmetry Elements - Study of Symmetry Elements, forms and representative minerals of Normal Classes of Isometric, Tetragonal, Hexagonal, Orthorhombic, Monoclinic and Triclinic systems - Twin crystals – Definition – Classification Types – Schemes.

UNIT VI: MINERALOGY

Definition of Minerals – Classification – Physical and Chemical properties of minerals - Petrological Microscope and its parts, accessory plates and uses – optical properties of minerals - Isotropic and Anisotropic Minerals - Descriptive study of Quartz and its varieties - Feldspar Group - Pyroxene Group - Amphibole Group - Mica Group - Garnet Group - Descriptive study of Calcite, Dolomite, Tourmaline, Topaz, Staurolite, Chlorite and Zircon.

UNIT VII: IGNEOUS PETROLOGY AND METAMORPHIC PETROLOGY

Definition of magma - Composition and constitution of magma - Forms and structures of Igneous Rocks, Textures and Micro structures – Tyrrell's and Tabular classification of Igneous rocks - Bowen's Reaction principle and series - Descriptive Study of Granites - Syenites - Diorites - Gabbro – Dolerites - Ultramafics - Dunites, Peridotites, Pyroxenites and Anorthosites - Differentiation - Assimilation. Metamorphism – Agents and kinds of metamorphism – Classification of metamorphic Rocks – Textures and structures – Different Facies and Zones – Descriptive study of Marble – Schist and Gneiss – Amphibolites – Pyroxenites – Granulites – Charnockites.

UNIT VIII: SEDIMENTARY PETROLOGY

Sedimentary Rocks - Classification - Texture and structures - Processes of formation, Diagenesis and Lithification – Properties of sediments - Descriptive study of Residual, Clastic, Chemical and Organic deposits – Sedimentary basins of India – Significance of Heavy minerals.

UNIT IX: ECONOMIC GEOLOGY

Definition of Ore - Tenor - Grade – Gangue - Lindgren and Bateman's classification of ore deposits - Ore forming processes - Magmatic concentration – Hydrothermal Process - Oxidation and Supergene Enrichment – Evaporation - Sedimentation – Placer deposits - Metallogenic epochs and provinces – Marine mineral resources and laws of sea beds - Important Ores, their composition, physical properties, mode of occurrences, distribution in India and uses of Gold, Iron, Aluminium, Manganese, Copper, Magnesium, Lead and Zinc, Lignite, Coal and Petroleum - Dimensional stones, their characteristics, distribution and mode of occurrences in India - Mineral Wealth of Tamil Nadu.

UNIT X: APPLIED GEOLOGY

Principles of Geological mapping and field Techniques – Rock Drilling methods - Borehole problems from borehole data – Geological investigations necessary for Dams, Tunnels and Road Construction - Landslides – Surface Mining methods - Role of geologist in Mining Industries – Environmental problems in Mining Industries – Urbanization and Groundwater problems – Applications of Remote Sensing and GIS

in Geological Studies -Occurrence of groundwater – Aquifers – Types of Aquifers – Porosity – Specific yield and retention – Hydrogeological properties of Rocks – Groundwater flow – Darcy's Law – Pumping tests parameters – Groundwater Drilling methods – Aquifer recharge – Electrical methods of groundwater exploration – seawater intrusion.

11. CHEMISTRY (Degree Standard)

CODE: 430

UNIT I: Physical Chemistry

Chemical Thermodynamics Terminology – Systems and surroundings - First Law of thermodynamics - CP and CV 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.

Solid State Chemistry 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 , TiO₂ and spinels.

UNIT II: Chemical 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.

Electrochemistry 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 (ΔG , ΔH , ΔS and K) Determination of pH and pK_a of acids by potentiometric methods.

UNIT III: Analytical chemistry and Instrumental methods

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

UNIT IV: Inorganic Chemistry

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

Chemical bond Lattice energy - VSEPR Theory and its applications - partial ionic character from electronegativity - Fajan's Rule.

Compounds of Boron Electron deficient nature of boron compounds - preparation and properties of halides and nitrides of boron - diborane - Borazine, silicones and structures of silicates

UNIT V: Lanthanides and Actinides

Position in the periodic table, occurrence, electronic configuration, oxidation state - lanthanide contraction - magnetic properties and complexation behaviour - comparison of lanthanides and actinides.

Nuclear Chemistry 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: Co-ordination Chemistry

Nomenclature – theories of co-ordination compounds - Werner, valence bond, crystal field theories - Effective atomic number – isomerism.

Analytical Chemistry Principles of volumetric analysis - different types of titrations- Gravimetric analysis – Basic principles - Separation and purification techniques

UNIT VII: Organic Chemistry

Nature of Bonding 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.

Types of reactions Nucleophilic, electrophilic, free radicals, addition, elimination, substitution, oxidation and reduction reactions.

UNIT VIII: Electron displacement effects Inductive, inductometric, electromeric, mesomeric, resonance, hyperconjugation and steric effects.

Stereochemistry 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: 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 - structure and functions of DNA and RNA

Hormones and vitamins: Classifications, sources and functions

UNIT X: Pharmaceutical Chemistry

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.

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

12. CHEMICAL ENGINEERING (Degree Standard)

CODE: 405

UNIT I: CHEMICAL PROCESS CALCULATIONS AND CHEMICAL ENGINEERING THERMODYNAMICS

Properties of gases, liquids and solids, Humidity and saturation, Gas laws, steady and unsteady state material and Energy balances including multiphase- involving recycle, by-pass and purge systems, Material and Energy balance with reactions, use of tie components, Gibbs Phase rule and degree of freedom analysis. Laws of Thermodynamics and its applications - Thermodynamics functions - Chemical and Phase Equilibrium -Ideal and nonideal gases and solutions – Equation of state and residual properties, compression of fluids, Second law and entropy, Chemical potentials, properties of mixtures- fugacity, partial molal properties, excess properties and activity coefficient. Predicting VLE of systems, Free Energy Change and Chemical Reaction Equilibrium.

UNIT II: MECHANICAL OPERATIONS AND ENGINEERING MATERIALS

Characteristics of solids, laws of size Reduction, free and hindered settling, centrifuge and cyclone, thickeners and classifiers, Mixing and agitation, Filtration, Sedimentation. Conveying of solids. Materials

of construction for chemical Industries, Metallic, Non-metallic, Polymeric and composite materials, Refractory, corrosion -prevention and control. Smart materials for Chemical Engineering applications- Nano and biomaterials.

UNIT III: CHEMICAL TECHNOLOGY AND RENEWABLE ENERGY SOURCES

Acids, Fertilizers, marine Chemicals, Cement, Glass, Ceramic and Refractories, Petroleum Refining Products, Fermentation Products, Oils, Soaps and Detergents, Pulp and paper, Dyes, sugar, leather and rubber, polymer, pharmaceutical and food industries. Sustainable energy resources - solar, thermal, photoelectric, tidal, geothermal, nuclear, wind, bio-energy, sources, energy storage and conversion- battery and fuel Cells, Energy efficiency estimation.

UNIT IV: FLUID MECHANICS AND HEAT TRANSFER OPERATIONS

Fluid Statics, Newtonian and Non-Newtonian fluids, Types of Manometers, Equation of continuity, Equation of motion, Bernoulli equation, Friction Factor, Dimensional analysis and similitude, Flow through pipes, velocity profiles, flow through fixed and fluidized beds, flow meters, Fans, blowers, pumps and compressors, Energy Equations, Modes of Heat transfers, Heat transfer with phase change, thermal insulation, thermal boundary layer and heat transfer coefficient. Design of heat exchangers- Double pipe, Shell and tube, single and multiple effect evaporators

UNIT V: MASS TRANSFER AND SEPARATION OPERATIONS

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 column, Extraction, Adsorption, Absorption, Drying, humidification and de-humidification. Crystallization, Membrane separation processes - frame, tubular, spiral wound and hollow fibre membrane reactors, dialysis, reverse osmosis, nano/ultra filtration, microfiltration. Ion Exchange chromatography and electrodialysis, Separations involving pervaporation and permeation techniques for solids, liquids and gases, supercritical fluid extraction.

UNIT VI: CHEMICAL REACTION ENGINEERING

Reaction rates - laws - theories and analysis, homogeneous and heterogeneous reactions, single and multiple reactions in ideal reactors. Kinetics of enzyme reactions. Non ideal reactors - Residence time distribution, Single parameter model. Design of reactors- Isothermal and adiabatic fixed bed reactors, non-isothermal and non-adiabatic fixed bed reactors, fluidized bed reactors. Kinetics of heterogeneous catalytic reactions. Diffusion effects in catalysis- rate and performance equations for Catalyst deactivation.

UNIT VII: PROCESS DESIGN, INSTRUMENTATION AND CONTROL

Problem formulation, degree of freedom analysis, objective functions, Simplex method, Barrier method, sensitivity analysis, Convex and concave functions, unconstrained NLP, Newton's method, Quasi-Newton's method, Direct substitution, Quadratic programming, Cost estimation, Plant utilities, Heat exchanger networks, Pinch technology. Principles of measurements and classification of process instruments, measurement of process variables - Laplace transformation, application to solve ODEs. Open-loop systems, first order systems, first order systems in series, linearization and its application in process control, second order systems and their dynamics; transportation lag. Closed loop control systems, feed-back control systems, BODE diagram, stability criterion, frequency response, tuning of controller settings, cascade control, feed forward control, control of distillation towers and heat exchangers.

UNIT VIII: NUMERICAL AND COMPUTATIONAL METHODS

Curve fitting, Equations with real and rational Coefficients, Imaginary roots and irrational roots, Transformation of equations. Numerical solutions of linear and non linear algebraic equations- solution of initial value and boundary value, ordinary and non-linear differential equations, Integration of trapezoidal and Simpson rule. Solution of partial differential equations. Partial Differential equation – finite element,

finite difference method - Matrix, determinants and properties – Elementary Row transformations algebraic equations; ordinary differential equations and non homogeneous first order ordinary differential equations, rank of Matrix, Eigen value problems, Orthogonal and ortho normal vectors; Gram-Schmidt orthogonalization; Theorem for Eigen values and Eigen functions.

UNIT IX: ENVIRONMENTAL ENGINEERING, OCCUPATIONAL SAFETY AND HEALTH IN CHEMICAL INDUSTRIES

Air, Water and soil pollution, causes, effects and remedies, Nuclear waste disposal, Noise control. Wastewater treatment by various methods: Chemical, biochemical and advanced oxidation process. Industrial hygiene, occupational safety & health in chemical industries, Industrial safety principles, site selection and plant layout, chemical hazards identification & 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.

UNIT X: PROFESSIONAL ETHICS, LAWS & LEGISLATIONS:

Morals, values and Ethics – Integrity – Work ethic - Valuing time – Cooperation – Commitment – Empathy – Senses of Engineering Ethics – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles – Theories about right action - Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law. Safety and Risk – Assessment of Safety and Risk – 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), Employee Discrimination. Multinational Corporations, Environmental Ethics & legislation – Engineers as Managers, Expert Witnesses and Advisors. Moral Leadership, Code of Conduct, Corporate Social Responsibility. Labour laws and legislations – Criminal procedure code – Indian Penal Code.

13. ELECTRICAL ENGINEERING / ELECTRICAL AND ELECTRONICS ENGINEERING (Degree Standard)

CODE: 400

UNIT I: ELECTRICAL CIRCUITS

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 – Sinusoidal Steady State Analysis of RL-RC-RLC Circuits- Resonant Circuits - Natural and Forced Response – Transient Response of RL-RC-RLC Circuits-Two-port networks – Three Phase Circuits-Star-delta transformation - real and reactive power-powerfactor

UNIT II: ELECTRIC AND MAGNETIC FIELDS

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

UNIT III: MEASUREMENTS AND INSTRUMENTATION

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-XY Recorder-Magnetic Recorders-Digital Data Recorder-Oscilloscopes-DSOLED and LCD Display-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

UNIT IV: CONTROL SYSTEMS

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 V: ELECTRICAL MACHINES

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 motorPermanent magnet brushless dc motor – stepper motor

UNIT VI: POWER SYSTEMS

Single Line Diagram of Power System-Per Unit Quantities-Power Generation Types- Hydro, Thermal and Nuclear Stations – Pumped storage plants – Co generation– Economic and operating factors – Modelling and performance characteristics of Power transmission lines and Cables-HVDC transmission– Mechanical Design of Transmission Lines-Sag-Insulators - ZBus and YBus formulation - Load flow studies – Shunt and Series Compensation - Symmetrical and Un symmetrical Faults 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 –AC and DC Distribution - deregulation-energy conservation and energy auditing

UNIT VII: ANALOG AND DIGITAL ELECTRONICS

Semiconductor Devices – PN junctions – Transistors – FET – Zener, Photo diodes and their applications – Rectifier circuits – Voltage regulators – Multipliers. 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 - Voltage Controlled Oscillator - Timer. 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 - Schmitt triggers-Memories (ROM,PLA and FPGA).

UNIT VIII: POWER ELECTRONICS AND DRIVES

Principle of Operation and 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 – Single and Three Phase AC to AC converters - 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- 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 IX: DIGITAL PROCESSORS AND COMMUNICATION

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. Digital Communication Systems: Pulse Code Modulation and Demodulation – Adaptive Delta Modulation - Frequency Division and Time Division Multiplexing – Data Communication Network Topologies - 7-layer OSI Protocol-IoT concepts

UNIT X: RENEWABLE ENERGY SOURCES AND STORAGE DEVICES

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.

14. MECHANICAL / MANUFACTURING / PRODUCTION ENGINEERING (Degree Standard)

CODE: 399

UNIT I: MECHANICS, KINETICS AND DYNAMICS

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

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 II: FLUID MECHANICS AND TURBO MACHINERY

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

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

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, Radioactive Heat Transfer.

UNIT VI: MATERIALS SCIENCE AND METALLURGY

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

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

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

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

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.

15. TEXTILE TECHNOLOGY (Degree Standard)

CODE: 406

UNIT I: FIBRE PROPERTIES AND MANUFACTURE

- (i) Classification of fibres, production of natural fibres - cotton, jute, silk, wool; Identification of natural and synthetic fibres
- (ii) Fine, gross structure and properties of fibres
- (iii) Microscopic, physical and chemical test methods for fibre identification; blend analysis
- (iv) Morphology characterization – Density, XRD, Electron microscopy
- (v) Thermal characterization methods - DSC, TGA, DMA / TMA, FTIR spectroscopy
- (vi) Mechanical – Tensile, Elastic recovery, Time Effect, Bending, Twisting and Compression
- (vii) Optical - Absorption and dichroism, Reflection and lustre.
- (viii) Electrical and Thermal Properties - Dielectric property, Static Electricity, Structural changes in fibres on thermal treatment.
- (ix) Moisture Property – Absorption, Desorption, Swelling, Theories of moisture sorption
- (x) Requirements of fibre forming polymers
- (xi) Spinning of Polymers - Melt Spinning, Wet spinning, Dry spinning, Dry-jet-wet Spinning and Gel spinning
- (xii) Post Spinning Operations – Drawing, Crimping, Heat setting, Tow-to-top conversion, Texturing methods.

UNIT II: YARN MANUFACTURE, YARN STRUCTURE AND PROPERTIES

- (i) Principle of ginning
- (ii) Blow room machines; principles of opening, cleaning and mixing / blending of fibrous materials; cleaning efficiency; calculations
- (iii) Carding machine; Fundamentals of carding, settings, card clothing, autoleveller; calculations
- (iv) Comber; Lap preparation, combing cycle, mechanisms; combing efficiency; calculations
- (v) Draw frame; doubling and drafting, settings, autoleveller; calculations
- (vi) Roving frame; drafting, twisting, bobbin building; calculations
- (vii) Ring frame; drafting, twisting, cop formation, forces acting on yarn and traveller; limitations, compact yarn spinning; calculations
- (viii) Ring doubler and TFO - principle; single and folded yarn twist
- (ix) Alternate Spinning systems - rotor, two nozzle air-jet, air vortex, friction, core, wrap, twist-less spinning process

- (x) Helical geometry, packing density, yarn diameter, yarn contraction, yarn twist and relation to yarn strength - staple fibre yarn and filament; mass irregularity of yarn; structure - property relations of ring, rotor, air-jet and friction spun yarns

UNIT III: WEAVING PREPARATORY AND WEAVING, FABRIC STRUCTURE AND PROPERTIES

- (i) Cheese, Cone winding - random and precision winding, winding parameters
- (ii) Yarn clearers and Tensioners; yarn splicing
- (iii) Types of warping - beam and sectional warping, pirn winding process;
- (iv) Sizing techniques, sizing of spun and filament yarns; Beam Gaiting
- (v) Principles of fabric formation in shuttle looms – primary, secondary and auxiliary motions
- (vi) Shedding – Types and Principles, Reversing Motions
- (vii) Beat up - types, kinematics of sley
- (viii) Principles of weft insertion in shuttleless looms - Rapier, air-jet, projectile, water-jet, circular and multiphase
- (ix) Basic woven fabric constructions and its derivatives - plain, twill, satin; honeycomb, warp and weft figuring, warp and weft pile, backed fabrics, double cloth Pierce's geometry of plain woven fabrics; structure - property relationship

UNIT IV: KNITTING and NONWOVEN MANUFACTURE

- (i) Knitting - yarn quality requirements, principles of weft and warp knitting
- (ii) Basic weft and warp knitted structures and its properties; calculations
- (iii) Circular, Flat and Warp knitting machines
- (iv) Geometry of plain knitted fabrics
- (v) Nonwovens – Needle punch, spun lace, spun bond, melt blown, thermal bond
- (vi) Finishing of nonwovens - mechanical, chemical

UNIT V: PREPARATORY AND COLOURATION

- (i) Preparatory processes for natural fibres, synthetics and common blends
- (ii) Classification of dyes, auxiliaries and their properties
- (iii) Dyeing of fabrics using various dye classes.
- (iv) Batch-wise and continuous dyeing techniques
- (v) Dyeing machines for fibre, yarn, woven and knitted fabrics
- (vi) Styles and methods of printing; print paste preparation
- (vii) Pigment printing
- (viii) Digital Printing and Transfer Printing
- (ix) Fixation and after treatment process
- (x) Washing and drying of fabrics
- (xi) Colour measurement and colour difference calculation of dyed fabrics
- (xii) Fastness to wash, perspiration, light and rub

UNIT VI: FINISHING AND SUSTAINABLE PROCESSING

- (i) Mechanical finishing of Textiles - shrink proof, raising and calendaring
- (ii) Heat setting of synthetic fabrics
- (iii) Chemical finishes - crease resistant, water proof, water repellent, flame retardant, soil release, UV resistant, anti microbial, anti-static, softening, stiffening, elastomeric, self cleaning
- (iv) Bio-polishing of cotton fabrics
- (v) Washing and fading of denim fabrics
- (vi) Eco-friendly processing; Eco standards and Eco labels
- (vii) Minimum application technique, waterless dyeing
- (viii) Characteristics of Effluent and Effluent treatment

UNIT VII: QUALITY EVALUATION OF TEXTILES

- (i) Sampling techniques
- (ii) Measurement of fibre properties - length, strength, fineness, maturity and trash
- (iii) HVI and AFIS techniques
- (iv) Determination of yarn properties - count, twist, strength and elongation, unevenness and hairiness
- (v) Determination of fabric properties - construction parameters, tear, tensile strength and elongation; air permeability, drape, bending, crease and wrinkle recovery, thickness, pilling, abrasion, shrinkage
- (vi) Low stress mechanical properties of fabrics - FAST and KESF
- (vii) Yarn defects and analysis; diagram, spectrogram, VL curve

UNIT VIII: GARMENT MANUFACTURE AND SPECIAL FINISHES

- (i) Fabric defects and analysis
- (ii) Garment manufacture - Pattern making, Marker planning, Spreading and Cutting,
- (iii) Stitches and Seams, Sewing defects
- (iv) Types of spreading, cutting and sewing machines; mechanisms and accessories
- (v) Sewing threads
- (vi) Components and trims
- (vii) Pressing, packing, care labels
- (viii) Garment Inspection and Merchandising

UNIT IX: TECHNICAL TEXTILES

Fibre, yarn and fabric requirement for

- (i) Industrial Textiles - Belts, Ropes, Tyre-cords, Coated abrasives
- (ii) Automotive Textiles - Filter fabrics, Airbags, Seatbelts
- (iii) Geotextiles – Applications in civil engineering
- (iv) Agriculture Textiles – Crop covers, bird nets, soil mats and sacks
- (v) Medical Textiles – Non-implantable, Implantable, hygiene products
- (vi) Protective Textiles - Ballistic textiles, cold protective clothing, UV Protection, Clean room garments
- (vii) Sports Textiles

UNIT X: MANAGEMENT OF TEXTILE INDUSTRY

- (i) Industrial Engineering – Work study, method study, motion study, work measurement
- (ii) Costing of yarn, fabric and garment; costing - elements, cost sheet, Balance sheet, P & L Account, ratio analysis
- (iii) Depreciation, investment appraisal techniques
- (iv) Management Tools – Lean, TQM, TPM, 5S, Kaizen, MIS, Supply chain management, six sigma, FMEA
- (v) Industrial safety and industrial hygiene
- (vi) Industrial relations and Labour laws
- (vii) Energy conservation in textile industry

16. ELECTRONICS / ELECTRONICS AND COMMUNICATION ENGINEERING (Degree Standard)

CODE: 403

UNIT I: SEMICONDUCTOR THEORY AND ELECTRONIC DEVICES

Intrinsic and Extrinsic semiconductors, Energy Bands, Diffusion and Drift current densities. PN junction diode, current equation, Transition and Diffusion capacitances, Zener diode, Tunnel diode, Varactor diode, Photo diode, Schottky diode, LED, BJT, FET, JFET, MOSFET, UJT, SCR, DIAC, TRIAC.

UNIT II: CIRCUIT THEORY, SIGNALS AND SYSTEMS

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, Wye-Delta transformation. 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, DTFT and Z- Transform – Recursive and non-recursive systems.

UNIT III: ANALOG CIRCUITS

BJT, JFET, MOSFET amplifiers – Biasing analysis, Small signal analysis and frequency response, BJT and MOSFET multistage amplifiers: Differential, Darlington, Cascade and Cascode, Feedback amplifiers, Tuned amplifiers, RC and LC oscillators, Power amplifiers. Rectifiers and wave-shaping circuits, Operational amplifier characteristics and applications, CMRR, slew rate, waveform generators, active filters, timers, PLL, VCO, ADC, DAC, Regulators and Converters.

UNIT IV: CONTROL SYSTEMS

Control system components, Feedback, Transfer function, Transient and Steady state analysis of LTI systems, Frequency response, Bode, Polar and Nyquist plots, Routh-Hurwitz and Nyquist stabilities, Lag, Lead, Lag-lead compensation, State variable model.

UNIT V: COMMUNICATION SYSTEMS

Random Processes: Stationary process, Ergodic process, Auto correlation, Power spectral density, White noise, Filtering of random signals through LTI systems. Analog Communication: Amplitude and angle modulation / demodulation, Spectral characteristics. Noise: Thermal noise, Noise figure and Noise temperature. Digital Communication: PCM, DPCM, ADPCM, DM, ADM, LPC. line coding schemes, Bandpass signaling: Binary and M-ary versions of ASK, PSK, FSK, BER and spectral characteristics. Principles of QAM, OQPSK, MSK, GMSK. Link budget calculations, Eye diagram, ISI, Symbol and carrier synchronization, Frame synchronization. Information Theory and coding: Entropy, Mutual information, Channel capacity (AWGN), Source coding and Channel coding techniques.

UNIT VI: ELECTROMAGNETIC THEORY

Divergence, Stokes, Coulomb, Poisson and Laplace Equation, Ampere's law, Biot-Savart law, Gauss law for magnetic fields, Maxwell's equations, Displacement current, Uniform plane waves, 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, S-parameters, Smith chart. Rectangular and circular waveguides. Dipole and monopole antennas, Linear antenna arrays.

UNIT VII: WIRELESS COMMUNICATION TECHNIQUES

Wireless channel characteristics, Frequency reuse, Channel assignment and handoff, Multipath effect, Spread spectrum, OFDM, Adaptive equalization, Rake receiver, Diversity techniques, MIMO systems.

UNIT VIII: DIGITAL SIGNAL AND IMAGE PROCESSING

DFT, FFT, Overlap and save methods, IIR filters: Butterworth and Chebyshev filters, Impulse invariant and Bilinear transformation methods, FIR filter: Linear phase design, Windowing techniques: Rectangular, Barlett, Hanning and Hamming, Digital Filter realization structures, Finite word length effects in IIR and FIR filters, Scaling, Decimation and interpolation, multirate signal processing. Image enhancement: Contrast enhancement, Histogram equalization, Filtering. Image compression: JPEG. Video compression: Intra-frame / Inter- frame redundancy and motion estimation.

UNIT IX: DIGITAL CIRCUITS

Number representations: Binary, Integer and Floating point numbers, Combinational logic circuits, Boolean algebra, Minimization of functions using Boolean identities and Karnaugh map, Logic gates and their static CMOS implementations, Arithmetic circuits, Code converters, Multiplexers, Decoders. Sequential circuits: Latches and flip-flops, Counters, Shift registers, Finite state machines, Propagation delay, Setup and hold time, Critical path delay. Data converters: Sample and hold circuit, ADC and DAC. Semiconductor memories: ROM, SRAM, DRAM. Computer organization: Machine instructions, Addressing modes, ALU, Data path and Control unit, Instruction pipelining.

UNIT X: DATA NETWORKS

OSI model, TCP/IP reference model, Data link layer: Framing, error and flow control, HDLC, P to P – Medium Access Control: Random and controlled access, Channelization. Network layer: IPV4 and IPV6, ARP and RARP, Network routing algorithms – Distance Vector routing, OSPF, Dijkstra's and Bellman Ford, Congestion control, Transport layer: TCP and UDP, Application layer: WWW, HTTP, FTP and TELNET.

17. GEOLOGY (PG Degree Standard)

CODE: 395

UNIT I: GENERAL GEOLOGY AND GEOMORPHOLOGY

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

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

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

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

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

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

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

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

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

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.

18. LIBRARY AND INFORMATION SCIENCE (Degree Standard)

CODE: 266

UNIT I: LIBRARY AND SOCIETY

- (i) Library as a Social Institution; Impact of Libraries on Social, Political, Economical, and Cultural aspects, Laws of Library Science.
- (ii) Types of Libraries – Public, Academic and Special Libraries; Library movement in India;
- (iii) Library Legislation; Public Library Act; Delivery of Books and Newspapers (Public Library) Act; Intellectual Property Rights – Copyright Act
- (iv) Library associations and Professional bodies – UNESCO, IFLA, ALA; CILIP; ILA; IATLIS
- (v) Role of government agencies in library development – RRRLF; UGC- INFLIBNET

UNIT II: LIBRARY MANAGEMENT

- (i) Management – Concept; Definition; School of Thoughts – Functions of Management; (POSDCORB); Library Authority and Committee.
- (ii) Library Sections and Routines – Acquisition, Technical, Maintenance, Circulation, Reference and Periodical.
- (iii) Human Resource Management – Job Analysis, Job Description, Recruitment, Selection, Training, performance Appraisal, training, motivation, etc.
- (iv) Financial Management– Budget – Types, Sources of income to various types of libraries, Physical facilities – Building and Furniture.
- (v) Library Records - Statistics; Reports

UNIT III: INFORMATION PROCESSING (LIBRARY CLASSIFICATION)

- (i) Library Classification – Concept; Definition; Need and Purpose
- (ii) Library Classification – Types: General and Special; 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 and Devices.
- (v) Notation – Types; Characteristics

UNIT IV: INFORMATION PROCESSING (LIBRARY CATALOGUING)

- (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
- (v) Subject Headings – Sears' List of Subject Headings, LCSH, Centralised and Co-Operative Cataloguing.

UNIT V: INFORMATION SOURCES

- (i) Information Sources – Types – primary, secondary, and tertiary; Print Vs. Electronic resources; Human Vs. Institutional
- (ii) Evaluation of Information Sources – Criteria
- (iii) Secondary Sources: Dictionaries, Encyclopedias, Indexing and Abstracting Sources, Directories, Biographical Sources; Geographical Sources
- (iv) Electronic Information Sources - Databases; Full-text databases
- (v) Information Sources – Discipline-oriented sources – Pubmed; INSPEC; etc; UGC- e-Sadhsindhu Open sources

UNIT VI: INFORMATION SERVICES

- (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, SDI
- (iv) Indexing and Abstracting services; Referral Service.
- (v) Reprography, Translation and other specialized services

UNIT VII: COMPUTER AND COMPUTER APPLICATION

- (i) Computer – Definition; Characteristics; Classification of Computers Hardware – Generations; Input and Output Devices; Secondary Storage Devices; Telecommunication – 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, ISDN.

UNIT VIII: RESOURCE SHARING AND NETWORKING

- (i) Resource sharing – Concept, Definition, Need, Purpose.
- (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, OCLC Worldcat; National – INFLIBNET, DELNET.

UNIT IX: INFORMATION SYSTEM

- (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 UNESCO, INIS, AGRIS, INSPEC, PUBMED, CAS; National – NISCAIR, DESIDOC.
- (iv) Library Consortia – Trends, Functions; UGC – e-sodhsindhu, N-LIST, CSIR Consortium.
- (v) Open Access movement; Open Access System.

UNIT X: DIGITAL LIBRARY

- (i) Digital Library – Concept, Definitions, Characteristics, Theoretical framework, Merits and Demerits.
- (ii) Digital Library Management – Design, Architecture, Standards.
- (iii) Digital Library Initiatives - Initiatives in India; Open Archives Initiatives.
- (iv) Metadata – Definition, Standards, Metadata Harvesting.
- (v) Digital Library – Building process – Digitization; Software and Hardware; Institutional repositories.

19. TRAVEL AND TOURISM (Degree Standard)

CODE: 353

UNIT I: PRINCIPLES AND PRACTICES OF TOURISM

Introduction to Tourism – Meaning and Scope, Concept, Components and types of Tourism – Emerging Trends – Evolution of Tourism in India – Ministry of Tourism – Government of India – Department of Tourism – Government of Tamil Nadu.

UNIT II: TOURISM PRODUCTS OF INDIA

Unique features of Tourism Products – Tourist attraction Hills / Beaches / Mountains / Water Bodies – Forts / Palaces / Fairs and Festivals / Folk Dances / Dance / Music - Art and Crafts – Temples / Churches / Mosque and other religious worship places – UNESCO World Heritage Sites – Flora and Fauna – Major wildlife Sanctuaries and National Parks – Major Tourist Circuits of India – Land, Air and Water based adventure activities, Guidelines and Regulations – Ancient Monuments Preservation Act, 1904 – Ancient Monuments and Archaeological Site and Remains Act, 1958.

UNIT III: TRANSPORT

History – Land – Water and Air – Air Industry / Airlines in India / Functions/ Present policies – Air Charters – Growth of Road Transport – Indian Road Network – Major Rail Network of India – Types of Rail Tours in India – Water Transport – History and Development – Historical Past – Cruise Ships – Ferries – Hovercraft – River and Canal Boats – Boat Houses.

UNIT IV: ACCOMMODATION OPERATIONS

Origin and growth of hotels – Classification of Hotels on the basis of Size, Location, Facilities, Plan, Service and Ownership – Allied Catering Services – Supplementary Accommodation House Keeping – Front Office Management – Booking Procedures – Types of Food and Beverages.

UNIT V: TOURISM MARKETING

Unique features of Tourism Marketing – Market Segmentation – Marketing mix – Tourists behavior – Distribution channel and its characteristics – Market research – Market forecast – Marketing Promotions –

Tools of Promotion – E-Marketing – Domestic and International Travel Marts – Branding of Tourism Products – “Incredible India” Campaign – “Enchanting Tamil Nadu: Experience Yourself” – Swachh Bharat Abhiyan – Destination Life Cycle.

UNIT VI: TOURISM POLICY AND PLANNING

Need and Objectives of Tourism Policy – John Sargent Committee – L.K.Jha Committee (Adhoc Committee), 1963 - National Tourism Policy, 1982 - Yunus Committee, 1988 – Tourism Finance Corporation of India – National Action Plan on Tourism, 1992 – National Tourism Policy-2002 – Tourism in Five Year Plans – Tourism Policies of Tamil Nadu.

UNIT VII: FUNCTIONS OF TRAVEL AGENCY AND TOUR OPERATION

Tour Operation Procedures – Tour Package – Itinerary Preparation – Tour Costing – Travel Formalities – Passport / VISA / Health Regulations / Travel Insurance / Customs Clearance / Foreign Exchange formalities – Baggage Rules.

UNIT VIII: TOURISM GEOGRAPHY

Physical Geography of India – Climate Sub-Continent - River System – Mountains – Plains – Political Geography of India – World Time Zone, GMT – India Time Zone.

UNIT IX: TOURISM ORGANISATIONS

Organisation and Functions of WTO, ICAO, IATA, PATA, TAAI, IH&RA, SIHRA, FHRAI, NTO.

UNIT X: IMPACT OF TOURISM

Positive and Negative – Socio-Cultural and Economic Impact – Physical / Environment Impact: Earth Summits.

20. ECONOMICS (Degree Standard)

CODE: 416

UNIT I: MICRO ECONOMICS

Definitions and Scope of Micro Economics – Importance of Micro Economics – Is Economics Positive or Normative - Law of Demand - Utility Analysis - Elasticity of Demand - Theory of Consumer Behaviour – Consumer Equilibrium - Consumer Surplus – Indifference Curve Analysis – Theory of Production - Definition – Production Function – Factors of Production – Least Cost Combination – Marginal Rate of Substitution – Laws of Returns – Returns to Scale – Producers Equilibrium – Producers Surplus – Economies of Scale – Cost and Revenue Curves in the Short-run and Long-run – Price and Output Determination under different Market Structures – Perfect and Imperfect Competitions – Theory of Distribution – Rent, Wages, Interest and Profit – Welfare Economics – Different concepts of Social Welfare.

UNIT II: MACRO ECONOMICS

Definition, Nature and Scope of Macro Economics – Circular flow of income – National Income - Definition, Concepts – Computation of National Income - Difficulties in calculating National income. J.B.Says' Law of Market - Keynesian Theory of Employment - Consumption Function and Investment Function - Multiplier - Accelerator - Inflation - Deflation – Trade Cycle.

UNIT III: MONETARY ECONOMICS

Barter Economy – Evolution of Money - Functions of Money – Classifications of Money- Significance of Money in Modern Economic life, Value of Money - Quantity Theory of Money – Cambridge Version – Fisher and Friedman - Keynesian Critique - Components of Money Supply and Demand – Functions of Commercial Bank and Central Bank - Monetary Policy - Functions of Money Market - Capital Market.

UNIT IV: PUBLIC FINANCE

Nature and Scope of Public Finance – Principle of Maximum Social Advantage – Theory of Social Goods – Public Expenditure – Causes and Growth – Principles of Taxation – Canons of Taxation – Types of Taxation – Incidence and Shifting of Taxation – Public Debt – Sources and Methods of repayment Management of Public Debt – Budget – Techniques – Types of Budgets – Fiscal Policy.

UNIT V: INTERNATIONAL ECONOMICS

Importance of International Trade – Basis of Trade – Classical Theory of International Trade -Ricardo's Comparative Cost Theory of International Trade – Heckscher-Ohlin Theory of International Trade – Exchange Rate – Balance of Trade and Balance of Payment – Difficulties – Measures – Free Trade vs Protection – International Liquidity – International Institutions – IMF and SDR – IBRD, WTO – UNCTAD.

UNIT VI: INDIAN ECONOMY – I

Meaning of Economic Development and Economic Growth – Difference between Economic Growth and Economic Development - Indicators of Development- Features of Indian Economy and Tamil Nadu Economy - Obstacles of Development - Economic and Non-economic Factors - Agriculture - Role and Importance - Low Productivity - Causes – Measures - Green Revolution - Land Reforms - Development in India and Tamil Nadu - Economics of Planning: Meaning and Objectives of Economic Planning – Types of Planning - Five Year Plans in India - Objectives of Indian Plans and Failures & Achievements - Industry – MSME and Large scale Industries - Development in India and Tamil Nadu - Industrial policy – 1948-1991 and 2022 - Trade Unions - Industrial Disputes –Measures to settle Industrial Disputes.

UNIT VII: INDIAN ECONOMY – II

Population – Causes for the growth of Population – Measures to control Population – Population Policy – Poverty – Causes, Alleviation Programmes in India and Tamilnadu – Rural Industrialisation – SIDCO – DIC – Industrial Estates – Role of Transport.

UNIT VIII: DESCRIPTIVE STATISTICS

Different data types – Nominal, ordinal, binary and categorical data types - Diagrammatic representation of data – Standard charts, curves diagrams and plots including box plots - Statistical measures – Measures of central tendency – Measures of dispersion - Regression and Correlation coefficient.

UNIT IX: SAMPLING METHODS AND STATISTICAL TEST

Official Statistical System in India - Sampling versus Census – preparation of schedules and questionnaires - Probability and non-probability sampling method including simple random sampling, systematic sampling, stratified sampling, cluster sampling. Single proportion, equality of two proportions (large sample) - single mean, equality of two population means (small and large samples) - single variance and equality of two variances - independence of attributes.

UNIT X: ETHICS IN RESEARCH

Scientific Methods - Types of Research – Research Process – Research Designs – Basics in Computers.

21. MATHEMATICS (Degree Standard)

CODE NO: 419

UNIT I: ALGEBRA AND TRIGONOMETRY

Theory of Equations: Relations between roots and Coefficients – Complex roots - Irrational roots –Related roots Transformations of equations- Reciprocal equations. Summation of Series: Binomial, Exponential

and Logarithmic series theorems - Summation of finite series using method of differences – Simple problems. Expansion of $\sin(x)$, $\cos(x)$, $\tan(x)$ in terms of x – Expansion of $\sin(nx)$, $\cos(nx)$, $\tan(nx)$, $\sin nx$, $\cos nx$ - Hyperbolic and Inverse Hyperbolic functions - Simple problems. 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.

UNIT II: CALCULUS

Differential Calculus: n th derivative - Leibnitz's theorem and its applications - Partial differentiation - Total differentials – Jacobians - Maxima and Minima of functions of two and three independent variables - necessary and sufficient conditions - Lagrange's method – simple problems. Curvature - radius of curvature in Cartesian coordinates - polar coordinates - equation of a straight line, circle and conic - p - r equations –evolutes - envelopes - Methods of finding asymptotes of rational algebraic curves with special cases. Integral Calculus: Methods of integration - Properties of definite integrals – Reduction formulae - Simple problems.- Double Integrals - triple integrals - applications to area, surface and volume - Beta and Gamma functions - properties and simple problems.

UNIT III: DIFFERENTIAL EQUATIONS AND LAPLACE TRANSFORMS

First order but of higher degree equations – solvable for p , solvable for x , solvable for y , Clairaut's form – simple problems. Second order differential equations with constant coefficients with particular integrals for e^{ax} , xm , $\cos mx$, $\sin mx$, $e^{ax}\cos mx$, $e^{ax}\sin mx$. Method of variation of parameters - Total differential equations - simple problems. Partial Differential equations: Formation of P.D.E by eliminating arbitrary constants and arbitrary functions – First order P.D.E - complete integral - Singular integral - general integral - Charpit's method - standard types $f(p,q)=0$, $f(x,p,q)=0$, $f(y,p,q)=0$, $f(z,p,q)=0$ and $f(x,p)=f(y,q)$ -Clairaut's form and Lagrange's equations - $Pp+Qq=R$ – simple problems. Laplace transform - inverse Laplace transform(usual types) - applications of Laplace transform to solution of first and second order linear differential equations (constant coefficients) – simple problems.

UNIT IV: VECTOR CALCULUS, FOURIER SERIES AND FOURIER TRANSFORMS

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.

Fourier Series: Expansions of periodic function of period 2π - expansion of even and odd functions - half range series.

Fourier Transform - Fourier integral transform (Complex form, no derivation) - sine and cosine transforms - simple properties of Fourier Transforms - Convolution theorem - Parseval's identity.

UNIT V: ALGEBRAIC STRUCTURES

Groups, subgroups, cyclic groups and properties of cyclic groups – simple problems - Lagrange's Theorem - Normal subgroups – Homomorphism - Automorphism - Cayley's Theorem - Permutation groups.

Vector Spaces: Definition and examples - linear dependence and independence - dual spaces - inner product spaces.

Linear Transformations: Algebra of linear transformations – characteristic roots – matrices - canonical forms - triangular forms.

UNIT VI: REAL ANALYSIS

Sets and Functions: Sets and elements - Operations on sets – functions – real valued functions – equivalence – countability - real numbers - least upper bounds.

Sequences of Real Numbers: Definition of a sequence and subsequence – limit of a sequence - convergent sequences - divergent sequences – bounded sequences -monotonic sequences - operations on convergent sequences - operations on divergent sequences – superior limit and inferior limit – Cauchy sequences.

Series of Real Numbers - Convergence and divergence - series with non- negative numbers - alternating series - conditional convergence and absolute convergence -tests for absolute convergence - series whose terms form a non-increasing sequence.

Limits and metric spaces: Limit of a function on a real line – metric spaces - limits in metric spaces. Continuous functions on Metric Spaces: Functions continuous at a point on the real line –reformulation - functions continuous on a metric space – open sets - closed sets - discontinuous functions on the real line. Rolle's theorem - Law of mean - Fundamental theorems of calculus -Taylor's theorem. Sequences and Series of Functions: Point wise convergence of sequences of functions - uniform convergence of sequences of functions.

UNIT VII: COMPLEX ANALYSIS

Analytic functions: Functions of a complex variable – limits - theorems of limits – continuity – derivatives - differentiation formula - Cauchy-Riemann equations, sufficient conditions - Cauchy - Riemann equations in polar form - Harmonic functions. Complex Integrals: Definite integrals – Cauchy's theorem – Cauchy's integral formula – Formula for higher derivatives. Series expansions: Taylor's series - Laurent's series - Zero's of analytic functions- Singularities. Poles and Residues: Poles - Residues – Cauchy's residue theorem - Evaluation of improper real integrals - Integrals involving trigonometric functions.

UNIT VIII: DYNAMICS

Kinematics of a particle – velocity – acceleration - relative velocity – angular velocity -Newton's laws of motion - equation of motion - rectilinear motion under constant acceleration - simple harmonic motion. Projectiles: Time of flight - horizontal range - range in an inclined plane - Impulse and impulsive motion - collision of two smooth spheres - direct and oblique impact - simple problems. Central forces: Central orbit as plane curve - p-r equation of a central orbit - finding law of force and speed for a given central orbit -, finding the central orbit for a given law of force. Moment of inertia: Moment of inertia of simple bodies - theorems of parallel and perpendicular axes - moment of inertia of triangular lamina – circular lamina - circular ring - right circular cone - sphere.

UNIT IX: OPERATIONS RESEARCH

Linear programming – formulation – graphical solution – simplex method Big- M method – Two-phase method-duality- primal-dual relation – dual simplex method – revised simplex method – Sensitivity analysis. Transportation problem – assignment problem. Sequencing problem – n jobs through 2 machines – n jobs through 3 machines – two jobs through m machines – n jobs through m machines PERT and CPM: project network diagram – Critical path (crashing excluded) – PERT computations. Inventory models: Basic concepts - EOQ models (a) Uniform demand rate infinite production rate with no shortages, (b) Uniform demand rate – Finite production rate with no shortages – Classical newspaper boy problem with discrete demand – purchase inventory model with one price break. Game theory: Two-person Zero sum game with saddle point – without saddle point – dominance – solving $2 \times n$ or $m \times 2$ game by graphical method.

UNIT X: STATISTICS

Statistics: Measures of central tendency – measures of dispersion – skewness- kurtosis. Sample space: Events - Definition of probability – Addition and multiplication laws of probability – Independence – Conditional probability – Bayes theorem – simple problems. Random Variables (Discrete and continuous) - Distribution function – Expected values & moments – Moment generating function – probability generating function – Examples. Characteristic function – Uniqueness and inversion theorems – Cumulants - Chebychev's inequality – Simple problems. Concepts of bivariate distribution – Correlation - Rank correlation coefficient – Concepts of partial and multiple correlation coefficients – Regression - Method of Least squares for fitting Linear, Quadratic and exponential curves - simple problems. Standard distributions – Binomial, Poisson, Normal and Uniform distributions – Simple problems.

22. STATISTICS

(Degree Standard)

CODE: 418

UNIT I: Descriptive Statistics

Uses, scope and limitations of Statistics - Collection, Classification and Tabulation of data - Diagrammatic and Graphical representations - Measures of location, dispersion, skewness and kurtosis – Correlation and regression – Curve fitting – Linear and quadratic equations by the method of least squares.

UNIT II: Probability Theory

Probability - Addition, Multiplication and Baye's Theorems and their applications. Tchebychev's inequality - Random variables – Univariate and Bivariate – Probability distributions – Marginal and conditional distributions – Mathematical expectations – Moments - Moment generating functions – Characteristic function and cumulant generating functions.

UNIT III: Probability Distributions

Discrete distributions – Binomial, Poisson, Geometric and Hypergeometric Continuous distributions – Uniform, exponential, normal, Gamma and Beta - Sampling distributions and standard error - student's 't', Chi-square and F statistic – Distributions and their applications.

UNIT IV: Estimation Theory

Estimation – Point estimation – properties of estimators - Neyman Fisher Factorization theorem, Cramer–Rao inequality, Rao–Blackwell theorem, Lehmann-Scheffe theorem (without proof) –MLE and method of moments estimation – Minimum Chi-square – Interval estimation for population mean and variance based on small and large samples.

UNIT V: Tests of Hypotheses

Hypothesis testing – Null and Alternative – Types of errors – Level of Significance - Power of test, Neyman Pearson lemma, UMP and Likelihood ratio tests, Test procedures for large and small samples – Independence of attributes, Chi-square test – Goodness of fit.

UNIT VI: Sampling Theory and Design of Experiments

Simple random sampling – Stratified, systematic, cluster (Single stage) - Estimation of mean and variance in SRS – Sample Survey Organisation – CSO and NSO – Sampling and non-sampling errors. Analysis of Variance – Principles of design - CRD, RBD and LSD – Factorial experiments 2^2 , 2^3 and 3^2 (without confounding) - Missing plot techniques.

UNIT VII: Statistical Quality Control and Operations Research

Concept of SQC – Control charts – $\bar{X}$, R, p and np charts – Acceptance sampling plan – Single and double – OC curves, ASN, ATI and AOQ - Attributes and Variables plan. OR Models – Linear Programming problems – Simplex method - Primal and dual – Transportation and Assignment problems – Network, CPM and PERT.

UNIT VIII: Time Series and Index Numbers

Time series – Components of time series – Trend and Seasonal Variations – Determination and elimination. Index Numbers – Construction and uses – Simple and weighted index numbers – Reversal tests – Construction and uses of cost of living index numbers.

UNIT IX: Vital Statistics

Vital Statistics – Importance-Collection - Mortality and its measurements - Life table construction and uses – Fertility and its measurements.

UNIT X: Statistical Computing using MS-Excel and SPSS

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 – Charts-Plotting Density Function and Distribution Function. Understanding on the usage of Statistical Package SPSS.

23. ARCHAEOLOGY (PG Degree Standard)

CODE: 314

UNIT I: CULTURAL HISTORY OF TAMIL NADU UPTO 1565 AD

Importance of Archaeology – Contributions during Sangam Age, Pallavas, Cholas, Cheras, Pandyas – Religion - Society - Material life - Monuments of Pallavas – Cholas – Pandyas – Vijayanagaras – Nayaks.

UNIT II: HISTORY OF ARCHAEOLOGY

Definition - Development of Archaeology in India – 15th to 19th centuries – 20th century – Archaeological Theories – New Archaeology – Contributions of Alexander Cunningham – Robert Bruce Foote – Burgess – Lord Curzon – Mortimer Wheeler – Relation between History and Archaeology, Geology and Archaeology, Anthropology and Archaeology - Contributions of Archaeological Survey of India, State Department of Archaeology - University Departments : University of Madras and Tamil University.

UNIT III: FIELD ARCHAEOLOGY

Exploration techniques – Exploration tools – Excavation methods – Horizontal and Vertical Excavations – Stratigraphical Analysis - Excavation equipments - Staffs – Documentation and Interpretation – Preparation of Excavation Report – Dating methods – Remote sensing in Archaeology – Digital Archaeology.

UNIT IV: PRE AND PROTO HISTORY OF INDIA

History of Indian Prehistory – Relation between Prehistory and Geology – Lower, Middle and Upper Palaeolithic periods – its distribution – Mesolithic period – its distribution – Neolithic period – its distribution – Stone tool industries – its functions – tool making technology – Chalcolithic culture – Harappan culture – OCP culture – Painting grey ware – Iron Age culture – Burial types in South India– NBP ware culture.

UNIT V: EPIGRAPHY AND PALAEOGRAPHY

Importance of Epigraphy – Asokan Brahmi and Kharosti scripts - Asokan Edicts – Development of Epigraphical studies in Tamil Nadu – Origin and Development of Tamil-Brahmi and Vatteluttu - Recent developments in fixing chronology of Brahmi – Detail Study of inscriptions at: Pullimankombai, Mangulam, Vikramangalam, Velvikkudi and Leiden grants Copper plates, Uttiramerur – Hero stone inscriptions - Irulapatti inscription – Inscribed sherds - Prasasti/Meykirti - Structure of an inscription.

UNIT VI : NUMISMATICS

Importance of Numismatics – Punch marked coins – Tribal coins – Coins of Indo-Greeks – Roman coins – Gupta coins – South Indian coinage – Sangam coinage – Satavahana coins - Pallava coins – Chola coins – Pandya coins – Chalukya and Rastrakuta coins – Hoysala coins – Vijayanagara coins – Symbols and Legends – Techniques - Mints.

UNIT VII: ART AND ARCHITECTURE

Harappan Art – Mauryan Art and Architecture – Stupa, Chaitya and Vihara architecture – Art and Architecture of Deccan – Sathavahanas, Chalukyas, Rastrakutas, Hoysalas, Vijayanagaras and Nayaks – Monolithic and Structural temples of Tamil Nadu - Rock cuts of Early Pandyas and Pallavas – Sculptural art of Pallavas, Early Pandyas and Cholas – Temples at Mamallapuram, Kanchipuram, Nartanmalai, Thanjavur, Gangaikonda Cholaapuram, Vettuvankoil, Srirangam, Madurai and Krishnapuram.

UNIT VIII: ICONOGRAPHY AND PAINTING

Mudras – Asanas – Vahanas - Saiva Iconography – Vaishnava Iconography – Iconography of Devis, Minor deities, Jaina and Buddhist iconography – Bronzes – Ornaments – Pallava and Pandya paintings – Chola paintings – Vijaya Nagara paintings – Nayaks paintings – Maratha paintings.

UNIT IX: CONSERVATION AND MUSEOLOGY

Importance of conservation – Conservation of Organic and Inorganic materials – Structural conservation – Archaeological code – Legal aspects relating to conservation and preservation – Origin of Museums in India - Types of Museum – Role of National Museum, State Museum, District Museum and Local Museum – Principles of Display – Documentation – Museum Architecture – Museum administration and establishment.

UNIT X: EARLY HISTORICAL ARCHAEOLOGY

Importance of early historical archaeology – Potteries of North India and South India – Excavations at Kodumanal, Sanur, Mangudi, Azhagankulam, Arikamedu, Kaveripumpattinam, Korkai, Uraiyur and Keeladi – Urbanisation during Sangam age – Excavations at Kausambi, Sisupalgarh, Sravasti, Mathura, Taxila, Lothal and Dolavira – Maritime trade with other countries

24. BOTANY

(PG Degree Standard)

CODE: 269

UNIT I: PLANT DIVERSITY – I, PLANT DIVERSITY – II AND ECONOMIC BOTANY

Plant Diversity – I Classification, structure and reproduction of Algae, Fungi, Lichens, Bryophytes, Pteridophytes and Gymnosperms, Ecology and Evolutionary trends.

Plant Diversity – II Taxonomy of Angiosperms - classifications of Bentham and Hookers, Engle & Prantl, Hutchinson and Takhtajan. Numerical Taxonomy and Chemotaxonomy.

Economic Botany- Study of plants as sources of food, (cereals, millets, pulses, oil seeds) fodder, forage, fatty acids, essential oils, wood, timber, fiber, paper, rubber, beverages, spices and condiments, drugs, narcotics, resins, gums, dyes and tannins, insecticides and pesticides, ornamental and medicinal – plants as indigenous medicine system (Siddha, Ayurveda & Unani) Bioactive compounds.

UNIT II: CELL BIOLOGY AND SEED BIOLOGY

Cell Biology - Cell as a unit structure and function - cell Theory. Organization of Prokaryotic and Eukaryotic Cells ultra Structure and Chemistry of plant Cell walls. Cell Organelles: Ultrastructural details and functions, including Cytoplasmic Membranes. Organization of Chromosomes and special types of Chromosomes. Cell division: Mitosis and Meiosis Chromosomal behaviour and their cytological significance.

Seed Biology - Definition – scope – Importance of seed as source of enriched nutrients – Chemical composition of cereals, millets, Common pulses and common oil – seeds. Seed development, phases of growth. Synthesis and accumulation of food reserves (storage proteins, carbohydrates, lipids, oils) Physiology of seed dormancy and germination. Methods to overcome seed dormancy. Early physiological events of seed germination. Hydrolysis and mobilization of reserve food materials from storage organ tissues to the germinating embryonic axis. Seed certification and quarantine.

Unit III: ANATOMY AND EMBRYOLOGY

Plant Anatomy – Wood Anatomy; Anomalous Secondary Growth – Anatomy of C₃ – C₄ leaves; stomata types – Nodal Anatomy. Angiosperm Embryology – Incompatibility (Gametophytic and Saprophytic) barriers to sexual incompatibility.

Unit IV: GENETICS AND PLANT BREEDING

Genetics - Mendelian Genetics - Development of Genetics and gene concept. Sex chromosomes and sex - linked inheritance, Cytoplasmic inheritance. Chromosome theory of inheritance, linkage, Chromosome mapping and Karyotype analysis. Male sterility and its significance. Population Genetics - Non random mating; Genetic Drift Hardy Weinberg law. Molecular Genetics: Nucleic Acids as genetic material – Structure and role of Nucleic acids in protein synthesis and replication. Modern concept of the gene – Cistron, Recon and Muton. Genetic code and regulation of Gene expression; Gene amplification – Transposons, modifiers of gene expression. Meiotic Drive. DNA replication in Prokaryotic (E.coil) and Eukaryotic. Semi conservative model of DNA replication. Rolling circle replication. Transcription in Prokaryotic and Eukaryotic polarity effect. Splicing. Genetic switch-Ribo switch. Wobble gene. Multiple factor interactions.

Plant Breeding – Objectives of Plant Breeding. Breeding methods for self – pollinated and cross pollinated plants. Selection Methods including distant hybridization method. Role of Polyploidy and induced mutations in crop improvement. Heterosis and Inbreeding Depression.

Unit V: PLANT PHYSIOLOGY AND BIOCHEMISTRY

Plant Physiology - Water relations of plants. Ion transport - Photosynthesis: mechanism and importance. Photo - Chemical reactions. Photo - Phosphorylation - Photolysis of water. Quantum efficiency – Carbon fixation in C₃ – C₄ cycles. CAM pathway Photo - respiration. Respiration and Fermentation - Respiratory Metabolism- Glycolysis TCA cycle (Kreb's) Electron Transport chain - Oxidative Phosphorylation – Pentose Phosphate Pathway - C₆/C₁ ratio; Pyruvate metabolism. Respiratory control and uncouplers. Nitrogen Metabolism. Biological Nitrogen fixation - Nitrate and sulphate Reduction - Ammonia assimilation GS/GOGAJ Pathways. Biosynthesis of Amino-acids- Reductive amination and Transamination - Role of ureides and amides. Plant growth Regulator Phytochrome and its role. Calcium – calmodulin concept – Agrochemicals – Stress physiology (Abiotic and Biotic Stress). Physiology of fruit development.

Biochemistry – Biopolymers – Structure and Chemistry of Carbohydrates, liquids, proteins and their monomers. Mechanism of Action. Enzyme kinetics-Michaelis-Menten constant. Regulation and modulation of enzyme action. Isoenzymes, Enzyme Catalysis and Ramachandran's curve. Fatty Acids and Lipid Biosynthesis and Metabolism – Gluconeogenesis and B-oxidation. Secondary Metabolites – Alkaloids. Steroids. Terpenoids. Phenolics. Glycosides – their chemical nature and role.

Unit VI: BIOPHYSICS AND BIOSTATISTICS

Bio Physics – Bioenergetics, Energy and work. Laws of Thermodynamics, Energy transduction in biological systems. Redox potential. Redox couples. ATP bioenergetics. Order of reaction. Photobiology: Dual nature of light. Characteristics of solar radiation, Solar energy, efficacy of atoms – Absorption spectra in molecules, energy states, De-excitation.

Bio Statistics – Sampling techniques, Central values (mean, mode, median). Dispersion: absolute Relative Probability: Binominal 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.

Unit VII: MICROBIOLOGY AND PLANT PATHOLOGY

Microbiology – Structure, Classification, mode of nutrition, reproduction of viruses, Mycoplasma, Bacteria and Protozoa, Microbes in air, soil and water. Pollution control using Micro – organisms – Role of microbes in waste water treatment. Biofertilizer. Food Microbiology – Agricultural Microbiology and Industrial Microbiology.

Plant Pathology – Important plant diseases in Tamil Nadu caused by Bacteria, Mycoplasma, Virus, Fungi and Nematodes. Modes of infection and dissemination, Physiology of Host-Parasite interaction-Host-in-built-defense mechanisms and methods of control-Biocontrol agents. Mechanism of action of microbes in higher plants. Role of Biocides. Integrated pest/pathogen Management.

Unit VIII: MORPHOGENESIS, PLANT TISSUE CULTURE, BIOTECHNOLOGY AND APPLICATIONS

Morphogenesis – Polarity, Symmetry and Totipotency, Morphogenetic Centres of origin and organization. Differentiations de- differentiations and re-differentiation of cells and organs. Morphogenetic factors.

Plant Tissue Culture – Methodology and application of cell, tissue, organ and protoplast culture from vegetative and reproductive parts – Meristem culture and its significance. Somatic hybrid and Cybrids. Synthetic seeds and their application.

Biotechnology – Definition – Historical account – Scope and importance of Biotechnology – Genetic Engineering and Gene cloning strategies. Vectors in gene cloning – Plasmids, Cosmids, Bacteriophages – Role in gene – transfer technology – Recombinant DNA Technology – Isolation and purification of DNA – DNA – sequencing; DNA – engineering through cutting and joining; Restriction Endonucleases and Ligases. Methods of Direct gene transfer; Hybridoma Technology – potentialities and limitations of Biotechnology. Transfer of novel gene including nif – genes. Expression of plant genes in Bacteria.

Applications of Biotechnology - Monoclonal antibody production; interferon production – Insulin Production – Humulin Production. Application of Biotechnology in Agriculture - Crop improvement and evolving of transgenic plants to combat diseases, insect, pest and abiotic stresses – (salt, heat, drought and frost). Bacillus thuringiensis and biocide production. Microbial Biotechnology – fermentation technology – fermentation as a biochemical process – Bioconversion – alcoholic beverages production. Antibiotics, fermentation Production of amino acids and vitamins organic acids. Microbial Single Cell Protein (SCP) production.

Unit IX: ENVIRONMENTAL BOTANY

Definition – History – scope and relationship of Environmental Botany to other Sciences. Modern concept of Ecosystem – Synecology – Modern concept of Biotic – Community. Major and minor communities. Method of studying plant communities, Principles of Phytogeography. Major ecosystems of the world. Their distribution and centres of accumulation. Vegetation types of India. Willis age and Area Hypothesis, Wegener's continental Drift hypothesis, Endemism. Modern concept of ecosystem: Components and functions – Ecological Pyramids – Ecological Niche Speciation – Population Ecology – Population growth – Biotic interactions – Succession and its types- Ecological compression (Lotka-Volterra model). Biogeochemical cycles. Plant indicators. Environmental pollution and abatement – water, air, land, radiation, noise, acid, rain green house effect. Ozone depletion, Brief outline of marine ecosystem and management, soil fertility and reclamation. Land application of sewage sludge. Advantages and disadvantages of sludge control and recommendation. Environmental management and legislation – Environmental conservation strategies. Environmental management and legislation Ecotechnology – formal and non-formal environmental education. Afforestation; Green – jobs, creating awareness among target-site people (Villages, tribal's, students, intellectuals, legislators/Policy makers). Inculcating environmental education is curriculum of School, College and University levels.

Unit X: BIORESOURCES, BIODIVERSITY CONSERVATION AND ETHANOBOTANY

Bio-resources – Definition – scope - enumeration and documentation of Bio-resources. Energy plantation, Hydrocarbons, Agroforestry, Social Forestry. Conventional fossil – fuel energy. Non- conventional energy sources (solar, wind, tidal, atomic) - Biophotolysis and hydrogen photo-production. Utilization and degradation of cellulose and lignin (litter) sewage and Garbage disposal. Bio-degradable and non-biodegradable garbage for waste. Utilization – conversion into manure (vermicompost) Non-biodegradable substances disposal by incineration. Biogas from Biomass. Methanogenesis.

Biodiversity Conservation – The need and necessity, Rio de Janeiro Earth, Summit (1992) Leipzig(W.Germany) Earth Summit(1995) Problems in patenting and trade related intellectual property rights(TRIPS). General Agreement of Trade and Tariff (GATT). World Trade Organization (WTO). Prevention of Bio-Piracy. Role of wild – life sanctuaries, National Parks, Sacred Groves in Biodiversity Conservation. Red Data Book – Information on endangered threatened and extinct plants and animals. Strategies for Biodiversity Conservation – in situ and ex situ conservation. Role of World Wild Life Fund (WWF).

Ethnobotany - Definition – scope – Tribes of Tamil Nadu – Their Socio-economic status Demography and distribution Folk- Ethano Medicines Linkages with other Sciences. Ethno-food – linkages with other Sciences. Ethno politics. Tribal involvement in Biodiversity conservation. Policies and programmes for upliftment of the various tribes in Tamil Nadu.

25. CHEMISTRY **(PG Degree Standard)**

CODE:244

UNIT 1

Reaction Kinetics:-

Rate laws - rates constant for first, second, third and zero order reaction - Half life period - Arrhenius theory - collision theory - Absolute reaction rate theory – ionic reaction - salt effect - catalysis – Laws of photo chemistry, quantum efficiency – photo physical processes of electronic excited molecules. Green Chemistry – reactions and reagents

Chemical Equilibrium:-

partial molar quantities, gibbs - Duhem equation, Equilibrium constant – temperature dependence of equilibrium constant - phase rule and its applications to two and three components systems.

UNIT 2

Solid State:-

crystal systems - designation of crystal faces, lattice structure and unit cell - law of rational indices - Bragg's law and x rays diffraction by crystals - schottky and Frenkel defects - Electrical properties - Insulators and semiconductors - band theory of solids –Superconductors – nano materials preparations and properties.

Electrochemistry:-

Types of Reversible electrodes - Nernst equation - calculation of thermo dynamic quantities of cell reactions - overpotential and hydrogen over voltage – Determination of pKa of acids by potentiometric methods - Kohlrausch's law - Ostwald's dilution law - Debye - Huckel Onsager equation for Strong electrolytes - (no derivation required) - Primary and Secondary fuelcells - corrosion and prevention – drycells and storage batteries

UNIT 3

Structure and Bonding:-

Electronic configuration of atoms, Term symbols and periodic properties of elements, Ionic radii, ionisation potential electron affinity, electronegativity, concept of Hybridization, molecular orbitals and electronic configuration of homonuclear and heter nuclear diatomic molecules, shapes of polyatomic molecules VSEPR theory, symmetry elements and point groups for simple molecules, Bond lengths, Bond angles, bond order and bond energies 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.

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.

Chemistry of Non - transition elements:-

General characteristics, structure and reaction of simple compounds - boranes - silicates Oxoacids of N,P,S and halogens - xenon compounds - inter halogens, Pseudo-halides and noble gas compounds – metal clusters – S,N ring and chain compounds - inorganic Polymers such as silicones, Borazines and phosphonitrilic compounds. IUPAC Nomenclature of simple organic and Inorganic compounds.

UNIT 4

Organic reaction mechanism:-

General methods (Kinetic and non Kinetic) of study of reaction mechanisms Methods of determining reaction mechanism. – isotopic labelling 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.

Chemistry of important organic reaction:-

Aldol condensation - Claisen condensation - perkin reactions - Cannizzaro reaction - Friedel-Crafts reaction - Favorski reaction - Stork enamine reaction - Michael addition - Baeyer-Villiger reaction - Chichibabin reaction - Asymmetric synthesis pericyclic reactions - classification and examples - Woodward and Hoffmann rules. - use of OsO₄, NBS, diborane, NaBH₄, LiAlH₄ in organic Synthesis.

UNIT 5

Quantum Chemistry:-

Planck's quantum theory wave - particle duality, uncertainty principle, operators and commutation relations, postulates of quantum mechanics, Schrodinger wave equation, particle in one dimensional box and three dimensional box - harmonic oscillator, rigid rotator and hydrogen atom, angular momentum, spin - orbit coupling. Classical thermodynamics and elements of statistical thermodynamics:-

First law of thermodynamics:- heat capacity - isothermal adiabatic processes - Thermochemical laws - Kirchhoff's equation second law of thermodynamics, entropy, in reversible and irreversible processes - Gibbs free energy and Helmholtz free energy - Third law of thermodynamics

UNIT 6

Spectroscopy:-

Rotational spectra of diatomic molecules - Isotopic substitution and rotational constants - vibrations spectra of linear symmetric, linear asymmetric and bent triatomic molecules - electronic spectra - selection rules - nuclear magnetic resonance - chemical shifts - spin - spin coupling - electron spin resonance and hyperfine splitting theoretical principles of mass spectroscopy. Applications of UV, IR, NMR, ESR and mass spectroscopy for structural elucidation of organic compounds, inorganic complexes and free radicals.

UNIT 7

Chemistry of Co-ordination Compounds:-

structural aspects, isomerism - octahedral and tetrahedral, crystal field splitting of orbitals - CFSE - magnetism and colour of transition metal ions - charge transfer spectra - crystal field theory and ligand field theory – MO theory complexes of pi acceptor ligands - stereochemistry of inorganic co-ordination compounds – ORD and CD Techniques.

Chemistry of lanthanides and actinides:-

Electronic configuration - occurrence and Separation techniques - oxidation states, colour. magnetic and spectroscopic properties – lanthanide contraction, use of lanthanide compounds as shift reagents.

UNIT 8

Organometallic compounds and bio inorganic chemistry:-

Metal carbonyls, Metal nitrosyls, metal alkyl, alkenes and arene compounds – organo metallic compounds in catalysis - Chemistry of porphyrins - chlorophyll hemoglobin, myoglobin, ferredoxin, rubredoxin, and cytochromes, copper proteins, enzymes, zinc enzymes, toxicity of metals and the effect of excess and deficient levels, metal complexes in therapy.

UNIT 9

Stereochemistry:-

Elements of symmetry - optical and geometric isomerism E. Z and R.S notation's - Conformational analysis of simple cyclic and acyclic systems - Effects of conformation on reactivity in acyclic compounds and cyclohexanes.

Carbohydrates:-

Classification - configuration and general reactions of monosaccharides - Chemistry of glucose, fructose, Sucrose and Maltose, Important compounds in chemistry - Dyes - aze, triphenylmethane, and phthalein groups - indigo - alizarin vitamins, hormones - antibiotics - proteins. Polymers: Preparation and uses of polyethylene, poly butylene PVC, Nylon - Ziegler - Natta catalysts –

UNIT 10

Instrumental methods of analysis:-

Adsorption, partition chromatography - Gas chromatography - HPLC – Solvent extraction and ion turla exchange methods - atomic absorption spectroscopy - Eletroanalytical techniques voltammetry, cyclic voltammetry, polarography, amperometry, Coulometry and conductometry, ion - Selective electrodes- TGA, DTA, DSC and ICP. Analysis of industrial products such as ores and Minerals, Coal, Water, Soaps & Detergents, Metals & Alloys, Manures & fertilizer, cement, Aggregate, Bricks, petroleum products, food & products, plastics.

26. HISTORY

(PG Degree Standard)

CODE: 317

Section – A - India through Ages

UNIT I: INDIAN RACES AND GEOGRAPHY

Influence of geography on Indian History - Pluri-culturalism – Unity in Diversity - Sources of Indian History - Beginning of historic period - Indus Valley Civilization – Area - features - Rig Vedic and - Later Vedic cultures - Challenges to Vedic religion and society – Rise of Jainism and Buddhism – Results.

UNIT II: ANCIENT INDIAN POLITY (UP TO 7TH CENTURY AD)

Persian and Greek invasions – Impact - Age of ancient Indian empires - Rise of Magada and The Mauryas - Asoka - His wars - Services to Buddhism - Deal of Kingship - Mauryan administration and art - The Kushans in the north – west - Kanishka's achievements. The Guptas – Chandra Gupta I - Samudra Gupta - Chandra Gupta II - Hindu revivalism -Popular devotion as an alternative to puritan faith – Religious Art - Rigidity of Caste system – Accounts of Fahien.- The Vardhana Kingdom – Harsh Vardhana as the last great ruler of ancient India.

UNIT III: ANCIENT AND PRE-MEDIEVAL TAMIL CULTURE

Sangam Age - Archaeological sites - Adichal Nallur - Pallavaram - Arikamedu – Keeladi - Sangam polity- The Kalabhras –The new findings on their importance - The Pallavas - Politics - society and culture - Relations with neighbours - The first Pandyan kingdom - The Greater Cholas and the Second Pandyan Kingdom – Their contribution to religion, art and literature – Spread of Tamil culture abroad.

UNIT IV: MEDIEVAL INDIA - RISE OF THE CRESCENT OVER THE SUB- CONTINENT

- (i) A result less episode-The Arab conquest of Sindh- Turkish invasions and the aftermath - Pathfinders - Mahmud of Ghazni - Muhammad of Ghore - The foundation of Delhi Sultanate- The Slave Rulers- Qutb-ud-din Aibak to Balban - The Khilji imperialism - Ala-ud-din Khilji - Tughluq Dynasty - Mohammad –bin-Tughluq - Feroz Tughluq – The Sayyids and Lodis - Delhi Sultanate – Administration – Society – economy – Religion and culture under them.
- (ii) Medieval Deccan-Cultures at conflict -Bhamini Kingdom- Muhammed Gawan- Hindus reaction to the Muslim might in Deccan- Foundation of Vijaya Nagar - Krishna Deva Raya – His achievements - Society and culture under Vijaya Nagar - Fall of Vijaya Nagar - Battle of Talikota (1565) - Impact of Vijayanagar on Tamil Nadu - The Nayak rulers of Tamil Nadu - their cultural contributions - Bhakti Movement- Sankara - Ramanuja - Madhwa – Kabir - Guru Nanak - Chaitanya - Ramananda - Vallabha – others.

UNIT V: THE SECOND PHASE OF ISLAMIC INDIA

- (i) The Greater Moghals - Babur- Humayun - Sur interregnum – Shershah – Akbar to Aurangzeb – Moghal policies of the North West - Rajputs- Hindus and Deccan- Shivaji the Deccan Ulcer – Religion and Society - Art and literature.
- (ii) Declining phase of the Moghals- Reasons – Advent of the Europeans – Trade settlements - Laying foundation of the British colonial empire in India – Anglo – French rivalry - Carnatic Wars in the Peninsula – Bengal Affairs - Battle of Plassey (1757) and after.

UNIT VI: BRITISH EMPIRE- EXPANSION AND CONSOLIDATION

- (i) Policies of conquests - Subsidiary Alliance- Lapse Doctrine - Wars with Mysore - Marathas - Sikhs, Burma - others - British East India Company's rule up to 1857 – Robert Clive - Warren Hastings - up to Dalhousie - Social and administrative and judicial reforms – Mahalwari- Ryotwari Permanent and other revenue settlements.
- (ii) Early Resistance to British Exploitation - Puli Tevan – Veera Pandia Katta Bomman In the far South - South Indian Rebellion (1800-1801) –The first organized anti – British uprising – Vellore Mutiny (1806) - Sepoy Mutiny (1857) - Results - End of the Company's rule – Queen's Proclamation.
- (iii) The Crown's Administration – Development of modern India - From Lord Canning to Lord Mount Batten – Local self government - Public Services - Bureaucracy- Growth of Education - Press - Transport and Communication.

UNIT VII: PRE AND POST INDEPENDENT INDIA

- (i) Indian National Movement- Causes for national awakening – Socio-religious reform movements of the 19th and 20th centuries with special reference to Tamil Nadu – Early national associations – Indian National Congress - Causes for its birth - The Moderates and the Extremists of the INC- Gandhian Era - Role of Tamil Nadu in the Freedom Struggle - E.V.Ramasamy and Dravidian Movement- Self Respect Movement- Justice Party and its reforms - Temple entry movement - Devadasi abolition - Upper garment agitation - Role of religious minorities in the Freedom Struggle.
- (ii) India Post Independence - The Congress Regime - Jawaharlal Nehru- Lal Bahadur Shastri - Indira Gandhi – Emergency - Coalition Politics - Morarji Desai - V.P.Singh - I.K.Gujral - Five Year Plans - India in world affairs - Non- Alignment - Peace keeping role - Panch Sheel- Assistance to the UNO- SAARC- BRICS- Nuclear and Space research- Human rights issues in India – Bhopal Tragedy- Narmada Bachao Andolan - Keela Venmani – Reservation – Issue of OBCs.- Media and its role.

Section –B –World through Ages

UNIT VIII: ANCIENT AND MEDIEVAL WORLD

- (i) Ancient civilizations – Egypt – Mesopotamia - Classical cultures of Greece and Rome - Christianity - Principles and spread- Monasticism .

- (ii) Medieval World - Islam -Rise and escalation - Legacy - Medieval European culture - Towns, guilds and Universities.

UNIT IX: MODERN GLOBAL TRENDS

- (i) Dawn of Modern Age - Fall of Constantinople – Impact- Renaissance- Maritime discoveries - Reformation - Counter Reformation - Rise of Nation States.
- (ii) People Vs. Rulers – Age of Revolutions - The Glorious Revolution – French Revolution - Russian Revolution - The Chinese Revolution - The Meiji Restoration – The American War of Independence - Unification of Italy and Germany.
- (iii) Science and Modernism – Industrial and Agricultural Revolutions – Course –Results.

UNIT X: END OF AFRO-ASIAN COLONIAL EMPIRES AND GLOBAL PEACE

First World War - The League of Nations - Rise and fall of Japan in Asia – World War II - Emergence of People's Republic of China(1949)- UNO and its achievements

27. ZOOLOGY (PG Degree Standard)

CODE: 271

UNIT I

Non-chordate: General Organization - classification upto class level, Modern taxonomy. Shelled Protozoans, Economic Importance, Fossil Protozoans and their importance, Neuromotor system in ciliates. Origin of Metazoa - Theories and Evolution, Economic importance of Porifera, Polymorphism in Hydrozoa. Coral reefs – structure, formation and theories. Origin and evolution of Coelenterates. Origin and types of coelom in Bilateria. Effects of parasitism on the parasites and hosts in Helminthes and larval forms. Coelom and metamerism in Annelida, Mode of life in polychaetes. Larval forms and parasitism in Crustacea. Adaptive radiation in Gastropods. Larval forms of Echinodermata and their Significance. Retrogressive Metamorphosis, Neotany and affinities of Ascidian.

UNIT II

Chordate: Migration in Fishes, Accessory respiration in fishes. Adaptation in deep sea fishes. Electric Organs and electro-receptors in fishes. Origin and evolution of Amphibia. Conquest of Land - Adaptations to live on land – evolutionary significance of crocodiles. Adaptive radiation in birds - Migration in Birds. Evolution: Origin of life - Bio-chemical evolution - cultural evolution. Present status of Natural Selection. Adaptation and evolution in mammals. Wild life mammals in India and Conservation measures. Endanger species and current status. Wild life Act.

UNIT III

Cell and Molecular Biology: Cellular organization-Membrane, intercellular-structure and function-cellular organelles. Chromosomes, types and Organization of genes. Cell division, cell cycle and regulation. Cell communication and cell signaling. Structure of DNA and RNA. Genetic code, Replication and protein synthesis. Bio-Chemistry: Structure of carbohydrates, amino acids, proteins, lipids – Glycolysis and Kreb's cycle - oxidation, reduction - oxidative phosphorylation energy conservation and release - cyclic AMP-ATP - saturated and unsaturated fatty acids - cholesterol – enzymes, mechanism, action and kinetics. Vitamins, trace elements and micronutrients and coenzymes. Antioxidant enzymes. Hormones-classification, biosynthesis and functions.

UNIT IV

Bio-Physics: Microscopy-Principles of Phase, Electron Microscope, Polarising, Fluorescent, Interference Microscope. Photo – Electric Calorimetry, Freeze drying - freezing, Microtome, Fixation, staining

techniques. X-ray - Diffraction, Ultra - Violet and infra red, Spectroscopy and Autoradiography. Instrumentation methods: Centrifugation, Electrophoretic and Chromatographic techniques. PCR, DNA finger printing, RFLP, RAPD, AFLP, FISH and GISH.

UNIT V

Genetics: Gene concept, one Gene - one polypeptide - concept, Enzyme regulation - Operon concept - GAL and LAC - Operon System. Population Genetics - Hardy - Weinberg Law Genetic Equilibrium. Radiation Genetics - mechanisms of Chromosomal breakage - Mutagens and Mutagenesis - Carcinogens and carcinogenesis – Human Genetics. Karyotype - Variation in Karyotypes with special reference to syndromes, Genetic counseling. Genetic Engineering - Present Status and its uses. Human genome project.

UNIT VI

Bio-Statistics: Collection of data. Primary and secondary - compiling and sampling methods - frequency distribution, frequency tables - diagrammatic representation - variables - measures of central tendency. Standard deviation, Standard error – Correlation, regression, regression analysis – student's "t" test and chi-square test. Bio-informatics: DNA and Protein sequence analysis, Prediction of functional structure, protein folding, Molecular docking, Metabolic and regulatory networks, General challenges and applications. SwissProt, NCBI: GENBANK, BLAST; Multiple Sequence Alignments.

UNIT VII

Physiology: With reference to mammals digestion, role of salivary gland liver, pancreas and intestinal glands in digestion, nutrition, balanced diet in man-assimilation, intermediary metabolism. Composition of blood- coagulation - Transport of oxygen, carbon dioxide, blood pigments-mechanism of respiration. Muscles, mechanism of muscle contraction, temperature regulation, acid, base balance and homeostasis. Nerve impulse conduction, neurotransmitters - receptors, photo, phono and chemo reception. Nephron and urine formation. Kidney stone formation. Comparison of excretion in fish, reptiles and mammals. Endocrine glands-testis, ovary and hypothalamo-hypophyseal gonadal relationship. Pheromones and reproduction. Bioluminescence, biological rhythms.

UNIT VIII

Immuno-Biology: Immune responses - Primary, Secondary and Theories. Immunity types – Innate - Acquired- cell mediated and Humoral immunity-Autoimmunity, Types of Antigens and immuno globulins. Vaccinations – ELISA, RIA Techniques. Developmental Biology: Gametogenesis, Fertilization: Significance, polyspermy Gynogenesis, Androgenesis, Parthenogenesis, Polarity, Symmetry, Radiant, Embryonic fields, Differentiation - Nuclear and Chemical factors, Inductors and organisers, Genes and organizers, Regeneration - Polarity and Gradient in regeneration. ART. Stem cell biology-sources, types and applications.

UNIT IX

Resource Ecology and Management, Renewable and Non-Renewable natural resources. Energy resources - conventional and non-conventional. Bioremediation. Habitat ecology. Wild Life conservation, Management and Acts. Air, Water, Soil, Sound pollutions. Laws related to Environment and Environmental Protection Act. Space ecology and Radiation ecology. Climate changes and Global warming.

UNIT X

Economic Zoology: Parasitism and commensalism - protozoan parasites and diseases - helminthes parasites and diseases on man and domestic animals; Beneficial and harmful insects - insect pests on crops and stored products. Control methods. Pheromones and IPM. Sericulture, apiculture, lac culture, sea weed culture, poultry, pisciculture and induced breeding. Shell fisheries - fin and shells. Aqua culture practices in Tamil Nadu and their impact on the environment and on agriculture.

28. COMPUTER SCIENCE AND ENGINEERING

(Degree Standard)

CODE: 407

UNIT I: C PROGRAMMING AND OOP

Data Types, Operators, Expressions, Type casting - Arrays – Structures, Unions - Enumeration Types – Bit fields - Storage Classes – Preprocessor directives - Functions, Recursion - Pointers to arrays, structures, unions and functions – Dynamic Memory Allocation – Files. Object Oriented Programming using C++ and Java: Classes – Objects - Methods – Constructors and Destructors – Scope – Data Encapsulation – Polymorphism - Overloading and Overriding –Inheritance – Types of Inheritance – Interfaces - Abstract Classes and Methods – Virtual Classes and Functions – Final Methods and Classes - Exception Handling - Assertions – Garbage Collection – Cloning – Reflections - Files. Streams – Formatted Input and Output – Collections – Generic Classes and Methods Multithreading – Object Concurrency – Serialization.

UNIT II: DATA STRUCTURES AND ALGORITHMS

Arrays – Searching and Sorting - Lists – Singly and Doubly linked lists – Stack Operations and Applications - Queue Operations and Applications – Trees – Binary Trees – Binary Search Trees : Representation, Traversals, Operations and Applications – AVL Trees, Heaps – Priority Queues – Graph – Representation, Traversals and Applications – Topological Sort – Hashing – Growth of Functions – Asymptotic Notation, O , Ω , θ – Recurrence Equations – Algorithms Design Strategies – Divide and Conquer – Quicksort, Merge Sort, Binary Search – Dynamic Programming – Warshall and Floyd's algorithms – Greedy Strategy – Minimum Cost Spanning Tree – Shortest Path Algorithm – Branch and Bound – Backtracking – String Matching algorithms – Naïve, Knuth Morris Pratt algorithm– NP Problems – Vertex Cover, Hamiltonian Cycle – Travelling Salesperson Problem – Approximation algorithms.

UNIT III: DIGITAL LOGIC AND COMPUTER ARCHITECTURE

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 – OpenMP – MPI – Cache coherence policies – GPU architectures and programming.

UNIT IV: OPERATING SYSTEMS AND SYSTEM SOFTWARES

Process Concepts – Process Scheduling, Context Switch – Operation on Processes - Threads - Types of threads, Multithreading. Uniprocessor and Multiprocessor scheduling, Real time scheduling – Inter process Communications: shared memory, message passing - Mutual exclusion, semaphores, monitors, reader-writer problem - Deadlock prevention, avoidance, detection, integrated deadlock strategy, Dining Philosopher's problem. Address binding, logical versus physical address space, dynamic loading and linking, shared libraries, overlays, swapping, contiguous memory allocation, paging, segmentation - Demand paging, page replacement, frame allocation, thrashing - I/O devices, Organization of I/O function, I/O buffering, Disk scheduling - File access and organization, File directories and sharing, Storage management - Linux Operating Systems features - Phases of Compilers - One and Two Pass Assemblers – Loaders, Linkers - Macroprocessors and Emulators.

UNIT V: DATABASE MANAGEMENT SYSTEMS

Database Applications – Data Models – Database Architecture – Key issues and Challenges in Database Systems – ER Models – ER to Relational Mapping – Object Relational Mapping – Relational Model -

Constraints – Keys – Dependencies – Relational Algebra – Normalization – First, Second, Third & Fourth Normal Forms – BCNF – Join Dependencies – SQL – Embedded & Dynamic SQL – Triggers and Views – Data Constraints – Database Security – Transaction Systems – ACID Properties – System & Media Recovery – Concurrency – Locking Protocols – Log Based Recovery – Two Phase Commit Protocol - Recovery – Deadlocks & Managing Deadlocks – Indexing & Hashing Techniques – Query Processing & Optimization – Sorting & Joins – RAID Levels – Database Tuning – Data Mining and Warehousing – NoSQL – Geographical Information Systems (GIS).

UNIT VI: SOFTWARE ENGINEERING

Software life-cycle and process models – Agile Models – Extreme Processing – Adaptive Software Development, Scrum – Dynamic System Development Models - Process Assessment Models; Project management activities. Requirements elicitation and analysis; Functional and non-functional requirements; User and system requirements, Requirement validation and specification. Design principles; System Models-Context, Behavioural, Data and object models, Architectural design-system structuring, Control models; Structured and object-oriented design; User interface design; Verification and validation planning; Test plan creation and test case generation; Black-box and White-box testing techniques; Unit, integration, validation and system testing; Object-oriented testing; Software inspections. Software maintenance; Reengineering; Legacy systems; Software reuse. Roles and responsibilities in a software team, Project Planning and Scheduling; Software measurement and estimation; Risk analysis and management; Quality management; Configuration management. Quality assurance and Process Improvement; ISO 9000, CMMI, TQM and Six Sigma; programming environments; Project management tools; Requirements analysis and design tools; Testing tools; Configuration management tools; CASE tools – Documentation Tools – Presentation Tools.

UNIT VII: COMPUTER NETWORKS AND SECURITY

ISO/OSI Model, Application Layer Protocols: HTTP, FTP, Telnet, Email, DNS – Performance Metrics, Transport Layer Protocols: User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Flow Control, Congestion Control – Network Layer Protocol: Internet Protocol, IPV4/IPV6 Packet Format, IP Addressing, Subnetting, Classless Inter Domain Routing (CIDR), BOOTP/DHCP, ICMP, Routing Principles, Distance Vector Routing, Routing Internet Protocol – Link State Routing Protocol, OSPF, BGP. Data Link Layer Protocol: Framing, Addressing, Error Detection/Correction – Multiple Access Protocols – Address Resolution Protocol (ARP) – Ethernet Basics, CSMA/CD, Frame Format, Switching, Types (datagram, virtual), Wireless LAN (802.11), Piconet, Bluetooth, Security: Modes of operation, Encryption Techniques, DES, Triple DES, AES, RSA, Diffie-Hellman Key exchange, Elliptic Curve Cryptography, Message Authentication codes, Hash functions, Digital Signatures, Kerberos, X.509, PGP, S/MIME, IP Security, Web Security, SSL, TLS, SET, System security, Attacks : DoS, DDoS, Ethical Hacking, Firewalls, Blockchain Technologies.

UNIT VIII: EMBEDDED SYSTEMS

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 – Register allocation – Conditional execution – looping constructs – bit manipulation – 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 – Design methodologies – Internet of Things (IoT) - Sensors.

UNIT IX: CLOUD COMPUTING AND VIRTUALIZATION

Cloud Components, Infrastructure, Architecture, Applications, Benefits, Limitations, Cloud Deployment Models, Cloud Technologies. Infrastructure as a Service (IaaS) – Storage as a Service – Compute as a Service – Platform as a Service (PaaS) – Software as a Service (SaaS): CRM as a Service, Social Computing Services, Document Services. Taxonomy, Server Virtualization, Desktop Virtualization, Network Virtualization, Storage Virtualization, Hypervisor. Hardware and Infrastructure – Server, Clients, Network, Software Defined Networks (SDN). Accessing the Cloud- Web Applications, Web API, Web Browsers. Scalable data storage techniques – Big Data Analytics. Map reduce Framework – Hadoop, HDFS. Artificial Intelligence – Machine Learning: Supervised Learning, Unsupervised Learning, Reinforcement Learning – Deep Learning – Transfer Learning – Natural Language Processing (NLP) – Data Visualization.

UNIT X: WEB TECHNOLOGY AND MOBILE COMPUTING

Internet and WWW Protocols, Client side Programming: HTML, CSS, JavaScript, XML, DTD, Schema, XSLT, server side Programming: Python, PHP, Web Servers: configuration, security, Core Java: I/O, Network Programming, RMI, JDBC, Swing, Advanced Java: JSP, Servlets, Beans, MVC. Web Frameworks: sessions, user management, legacy databases and applications, Web Application development. Web Services: SOAP, UDDI, WSDL, Smart Devices and Mobile Operating Systems. Data compression and decompression – Augmented Reality/Virtual Reality. Mobile Computing: GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA, Recent Mobile Technologies – Mobile Application Development – Digital Marketing – E-commerce.

29. INFORMATION TECHNOLOGY (Degree Standard)

CODE: 408

UNIT I: PROGRAMMING IN C, PYTHON AND OBJECT ORIENTED PROGRAMMING

C Programming: Introduction to IT – Problem Solving – C Programming – Constants – Variables – 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

Linear Data Structures – Abstract Data Types (ADTs) – 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- Back Tracking-Complexity classes – P, NP, NP Complete, NP Hard.

UNIT III: DIGITAL PRINCIPLES, COMPUTER ORGANIZATION AND IoT CONCEPTS

BOOLEAN ALGEBRA AND LOGIC GATES – Review of Number Systems – Arithmetic Operations – Binary Codes – Boolean Algebra and Theorems – Boolean Functions – Simplification of Boolean Functions using Karnaugh Map and Tabulation Methods – Logic Gates – NAND and NOR Implementations. COMBINATIONAL LOGIC – Combinational Circuits – Analysis and Design Procedures – Circuits for Arithmetic Operations, Code Conversion – Decoders and Encoders – Multiplexers and Demultiplexers – Introduction to HDL – HDL Models of combinational circuits – SEQUENTIAL LOGIC - Sequential Circuits – Latches and Flips Flops – Analysis and Design Procedures – State Reduction and State Assignment – Shift Registers – Counters – HDL for Sequential Logic Circuits – Computer Organization – Components of a computer system – Technology – Performance – Power Wall - Uniprocessors to multiprocessors; Instructions – operations and operands – representing instructions – Logical operations – control operations – Addressing and addressing modes – ALU – Addition and subtraction – Multiplication – Division – Floating Point operations – PROCESSOR AND CONTROL UNIT – Basic MIPS Implementation – Building datapath – Control Implementation scheme – Pipelining – Pipelined datapath and control – Handling Data hazards & Control hazards – Exceptions – MEMORY AND I/O SYSTEMS – Memory hierarchy – Memory technologies – Cache basics – Measuring and improving cache performance – Virtual memory, TLBs – Input/ output system, programmed I/O, DMA and interrupts, I/O processors. 8-Bit Embedded Processor - IOT Devices – Arduino - Sensors and Actuators - IOT Communication Models and API – Communication Protocols - Programming and Interfacing - Connecting to the Cloud.

UNIT IV: PROBABILITY AND QUEUEING THEORY

RANDOM VARIABLES – Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – TWO – DIMENSIONAL RANDOM VARIABLES – Joint distributions – Marginal and conditional distributions – Covariance – Correlation and Linear regression – Transformation of random variables – RANDOM PROCESSES – Classification – Stationary process – Markov process – Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations – Limiting distributions – QUEUEING MODELS – Markovian queues – Birth and Death processes – Single and multiple server queueing models – Little's formula – Queues with finite waiting rooms – Queues with impatient customers: Balking and reneging.

UNIT V: DATABASE MANAGEMENT SYSTEMS

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 Introduction to Distributed Databases – Multidimensional and Parallel databases – Spatial and Multimedia databases – Mobile and web databases – Data Warehouse – Mining – Data marts - NoSQL Database-CAP Theorem - Document Based Systems-Key Value Stores-Column Based Database-Graph Database-Database Security-Access Control Mechanisms-Big Data-Big Data Analytics-Big Data Tools

UNIT VI: OPERATING SYSTEMS AND CLOUD TECHNOLOGIES

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.

Distributed Systems: Distributed System Models-Distributed Communications-Global States-Causal Ordering of Events-Distributed Mutual Exclusion Algorithms-Deadlock detection in Distributed Systems-Consensus and Agreement Algorithms

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 VII: SOFTWARE ENGINEERING

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 VIII: WEB TECHNOLOGY

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 IX: COMPUTER NETWORKS

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 X: ARTIFICIAL INTELLIGENCE, MACHINE LEARNING AND DATA SCIENCE

Artificial Intelligence: Problem Solving Agents-Search Algorithms- Uninformed Search strategies-Heuristics Search Strategies-Local Search and Optimization Problems-Adversarial Search –Constraint Satisfaction Problem (CSP)-Logics-Propositional Logic-First Order Logic- Reasoning: Probabilistic Reasoning

Machine Learning: Types of Learning-Linear Regression Models and Types-Logistic Regression-Bayesian Linear Regression - Gradient Descent- Linear Classification Models - Discriminant Functions – Probabilistic Discriminative Models-Probabilistic Generative Models- SVM-Decision Tree - Naïve Bayes-Bayesian Modelling - Ensembling-Bagging and Boosting – Stacking - Random Forest -Clustering-Gaussian Mixture Models - Expectation Maximization Algorithm - K Means – Probabilistic Graphical Models – HMM - Bayesian Inference - Neural Network - Multi Layer Perceptron - Feed forward Neural Networks - Back Propagation – Regularization

Data Science: Types of Data and Variables - Describing Data – Describing Relationships – Statistical Testing-Python Libraries for Data Wrangling – NumPY – Pandas -Data Visualization – MATPlotLIB – Seaborn – Keras - Tensor Flow.

30. DAIRY SCIENCE (PG Degree Standard)

CODE: 458

UNIT I: Market Milk

Status and prospects of dairy industry in India. Operation flood program. Technology mission on dairying. Milk production trends and dairy development through successive national plans. Recent policy changes to dairy sector (WTO/GATT) and their impact on dairy industry in the country. National Dairy Plan, National Livestock Mission and DDF. Importance of various milks in milk processing. Impact of milk processing on major and minor constituents of milk. Methods of milk procurements, payments for quality assessment, handling and transportation of milk to processing dairies. Milk preservation, methods of chilling milk, centrifugal separation, clarification and bacto-fugation and factors affecting their efficiency. Homogenization process and its implications in dairy industry. Theories of homogenization and factors affecting it. Thermal processing of milk. Principles and methods of thermalization, pasteurization and sterilization and UHT. Refrigeration and its uses. Special milks-principles of production, processing and marketing of toned, doubletoned, reconstitute and recombined sterilized, flavoured and filled milk. Standardization of milk.

UNIT II: Dairy Technology-I

Indigenous Milk Products: Significance of role of indigenous dairy products in Indian dairy industry and economy. Characteristics and composition of various indigenous milk products, their prospects and constraints. Status of organized and unorganized sectors in the manufacture of these products. Methods of production, Physico-chemical changes during manufacturing; quality attributes shelf life, preservation, packaging and latest processing innovation of khoa, chhana and paneer. Fat rich Dairy Products: Basic principles of manufacture and quality aspects of cream. Manufacture of butter by batch method. Continuous butter manufacture. Factors influencing churning. Churning theories. Grading of butter. Defects and remedies, problems of butter storage. Over run in butter. Cost of butter production. Recent technological advances in butter industry. low fat spread. Methods of ghee making. Innovation in ghee production procedure, packaging, preservation, changes during manufacture, shelf life and defects in ghee. Frozen milk Products: Definition, classification, composition of ice cream and other frozen desserts, status, trends and projection of frozen milk products industry in India. Role of mix constituents and other ingredients, process steps, packaging and storage on ice cream quality. Technological aspects of ice cream manufacture. Recent advances in ice cream industry and their impacts. Indigenous frozen desserts kulfi, Malai ka Baraf, filled and Imitation ice cream, their production and quality.

UNIT III: Dairy Microbiology of milk products

Bacteriological Techniques, Basic principles underlying the routine and research methods for enumeration, isolation, cultivation and study of micro-organism, microscopy (including elementary principles of phase-contrast and electron microscopes) and staining procedures, preparation of nutrient media, methods used for identification of organism and taxonomic studies, methods of detection (estimation wherever necessary) and testing of metabolic products of bacteria; Micro-biological assay Routine bacteriological tests for milk, detection of bovine mastitis, general methods and principles involved for efficiency of cleaning and sterilization, methods of checking the conditions of milk-production for efficiency of processing (different tests). Micro-organism in milk and milk products, micro-organisms in milk: milk as a nutrient medium for bacterial growth, inhibitory substances in milk, sources of contamination during production, handling and distribution of milk, important groups of bacteria occurring in milk, thermophilic and thermophilic bacteria, activities of different species in milk and sequence of fermentation Processing of milk, methods of processing commonly employed, bacteria surviving pasteurization and boiling. Microbiology of milk products. Role of lactic acid bacteria and other micro-organisms in manufacture of butter, cheeses and fermented milks, spoilage of various milk products by micro-organisms. Bacteriology of starter cultures: Preparation and maintenance of starter culture, Types, tests for checking their purity and efficiency, bacteriophage, contamination of starters. Dairy Sanitation, Public Health and Microbiology of sewage and Environment: Clean milk production general principles of sanitary milk production, cleaning and sterilization of dairy utensils. Milk and public health: Transmission of diseases of bovine and human origin through milk products. Safe milk and methods to ensure supply of safe milk.

UNIT IV: Dairy Technology- II

Cheese and fermented milk products: Technology of cheese. Status and scope of cheese in dairy industry. Definition, classification and standards of cheese. Milk in relation to modern cheese making process. Treatment of milk for cheese manufacture and their consequences. Manufacture of cheddar, Gouda, Mozzarella, Swiss, Cottage and Roquefort cheese. Role of starter culture in cheese quality. Status of calf and microbial rennets for cheese manufacture. Yield optimization. Physical chemical changes during cheese ripening. Manufacture of process cheese and cheese spread. Packaging, storage and defects of cheddar cheese, their causes and prevention. Manufacture of low fat and low sodium cheese and process cheese. Advance in processing, manufacturing, storage and packing of Dahi, Yoghurt, Shrikhand, MistiDahi, Lassi, khafir, acidophilus and bifido milk. Probiotic – Prebiotic, postbiotic and synbiotics milk products. Concentrated and Dried milk products. Newer concepts in milk quality relation to processing and manufacture of concentrated and dried milks. Role of milk constituents in condensed milk. Principles and methods of manufacture, packaging and storage defects in SCM, EMand, RSCM, REM and dried milks WMP, SMP and instant milk powder. Heat stability and its control. Special problems in handling buffalo milk for manufacture of concentrated and dried milk and infants milk foods. Utilization of Whey for WPC, WPI, WPH and uses.

UNIT V: Dairy Chemistry

Chemistry of Lactose, Significance of lactose in milk and milk products. Chemical properties, fermentation of lactose, manufacture of lactose, use of lactose. 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, biosynthesis of fat. Mineral constituents of milk- General description, Importance, distribution, variation, effect of incineration and souring of milk on its mineral constituents, factors affecting the composition of mineral matter, effect of various treatments on salt equilibrium Vitamins and enzymes- General description, classification and importance. Chemical changes occurring during storage of milk.

UNIT VI: Rheology and Packaging of milk products

Rheology of Dairy Foods – Introduction to rheology to foods, physical consideration (Stress –strain relationship) in the study of foods, viscoelasticity - importance and practical application in selected dairy products, type of texture in food rheological determination indifferent food stuffs hydrocolloids and influence of food additives (stabilizer+emulsifier) on rheology of different food products. Critical review of the existing knowledge of identification of gaps and problems in current packaging of products and adhesive, graphics and labeling used in food packaging. Protective packaging (MAP, Vacuum Packaging, Active and intelligent packaging) of food, packaging of food products sensitive to oxygen, light, moisture and insect resistant packaging, retention of volatile flavours in food through packaging and special problems in canned foods, packaging of dairy products, fluid milk, cream, butter, cheese, Indian milk products, dried and frozen dairy products.

UNIT VII: Dairy Plant Management:

Location, design, arrangement of floor space and constructional details. Metal and materials used in dairy utensils and machinery. Selection and purpose of equipment. Inspection of premises and protection from contamination. General cleanliness and sanitation of plant. Washing and sterilization of dairy equipment, bottles and cans. Construction, operation and maintenance and technical control methods of equipment: such as heat exchangers, pasteurizers, homogenizers, bottle filler, bottle washer and can washer. Constructional and technical control methods and equipment used for manufacture of different milk products. Methods of disposal of dairy effluents. Evaluation of Sanitizers and Brine: Controlling the alkalinity and PH of detergent solutions. Preparation and evaluation of chlorine sanitizers. Maintenance and checking the strength of brine solution. Role of hardness of water in the dairy and methods of overcoming the problem.

UNIT VIII: Dairy Quality Control

Legal standard for market milk and milk products. Procedure of sampling. Good laboratory practices, Calibration of glass wares, Regulatory institutions involved in quality assurance of milk and milk products, Examination and testing for chemical and bacteriological qualities. LP System and its use in preservation of milk. Quality control of butter and ghee and its grading under AGMARK. PFA and BIS and legal aspects of various indigenous milk products. Milk preservatives and their detection. Adulterants of milk and milk products and their detection. Rapid platform tests and tests for detection and control of bovine mastitis. Quality systems such as HACCP, ISO.

UNIT IX: Dairy husbandry

Breeds of Dairy cattle. Indigenous, Exotic and Cross bred Cattle breeds. Lactogenesis and Galactopoiesis. Let down of milk. Milking procedure and practices for clean milk production: Methods of milking. Economic traits of Dairy cattle. Systems of Dairy cattle breeding. Breeding systems suitable to enhance milk production in India. Diseases of Dairy cattle – bacterial, viral, parasitic, nutritional and metabolic deficiency diseases and their control. Significance of mastitis and other diseases of economic importance. Management of milch animals, pregnant animals, dry animals, heifers and calves. Milk secretion, its theories and biosynthesis of milk constituents. Detailed composition of colostrums and milk of cattle and buffalo and factors affecting the same. Determination and significance of colour, specific gravity, refractive index, surface tension, viscosity, specific heat, electrical conductivity, osmotic pressure, boiling point, freezing point, acidity, pH, buffering capacity, oxidation and reduction potential.

UNIT X: Utilization of milk by-products

Status, availability and utilization of dairy by products. Associated economic and pollution problems. Manufacture of casein, sodium and calcium- caseinate, edible casein, hydrolysate, co-precipitates, whey protein concentrate and whey beverages. Use of buttermilk.

31. FOOD TECHNOLOGY / FOOD PROCESSING

(Degree Standard)

CODE: 455

UNIT I: PRINCIPLES OF FOOD TECHNOLOGY

Introduction to food technology- Causes of food spoilage, sources of microbial contamination of foods, food borne illnesses, water activity and its relation to spoilage of foods - Spoilage of processed products and their detection- Principles and methods of food preservation-Methods of food preservation such as heat processing, pasteurization, 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, bacteriofugation, ultra high voltage electric fields, pulse electric fields, high pressure processing, irradiation, thermosonication), alternate-thermal technologies (ohmic heating, dielectric heating, infrared and induction heating).

UNIT II: HEAT TRANSFER, REFRIGERATION AND COLD CHAIN

Basic transfer processes – conduction – Fourier’s fundamental equation – thermal conductivity and thermal resistance - linear heat flow – heat transfer through homogenous wall, composite walls, radial heat flow through cylinders and spheres – critical thickness of insulation -extended surfaces – Newton Rikhman’s law – film coefficient of heat transfer - convection – free and forced convection - Radiation heat transfer – concept of black and grey body - monochromatic total emissive power – Kirchoff’s law – Planck’s law – Stefan Boltzman’s law – emissivity - absorptivity, reflectivity and transmissivity. 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.

UNIT III: FOOD GRAIN PROCESSING

Structure, composition of different grains like wheat, rice, pulses, oil seeds, barley, corn and millets. Milling of wheat. Wheat flour/semolina and its use in traditional/non-traditional foods like breads, biscuits, cakes, doughnuts, buns, pasta goods, extruded, confectionary products, breakfast and snack foods. Milling and parboiling of rice; by-products of rice milling and their utilization - processed products from rice. Pearling, malting, brewing and preparation of malted milk feeds from barley. Wet and dry milling of corn, manufacture of corn flakes, corn syrup, corn starch, corn steep liquor and germ oil. Milling and processing of pulses-Use in traditional products, protein concentrates and isolates. Oilseed processing. Oil extraction and its processing - oil refining. Production, packaging and storage of vanaspati, peanut butter, protein concentrates, isolates and their use in high protein foods. Millets: nutritional significance, structure and processing.

UNIT IV: FRUITS AND VEGETABLE PROCESSING

Post harvest handling and storage of fresh fruits and vegetables- Preparation of fruits and vegetables for processing- Minimally processed products. Cold chain logistic- ZECC (Zero Energy Cool Chambers), CCSR (Charcoal cool storage Rooms) Thermal processing and process time evaluation for canned products, process optimization, aseptic canning, methods for canning of different fruits, and vegetables; Dehydration and associated quality changes during drying and storage of dehydrated products. Solar drying. Intermediate moisture foods. Preparation and utilization of fruits and vegetables juices in non-fermented/ fermented/ aerated beverages, health drinks. Membrane technology-Processing methods of frozen fruits and vegetables, IQF products, packaging, storage and thawing.-Beverages, tea, cocoa and coffee processing - Spice Processing viz. cleaning, grading, drying, grinding, packaging and storage - Oleoresins and essential oils.

UNIT V: TECHNOLOGY OF MILK AND MILK PRODUCTS

Milk and Milk production in India. Importance of milk processing plants. Dairy plant operations viz. receiving, separation, clarification, pasteurization, standardization, homogenization, sterilization, storage, transport and distribution of milk. UHT, toned, humanized, fortified, reconstituted and flavoured milks. Technology of fermented milks. Milk products processing viz. cream, butter, ghee, cheese, condensed milk, evaporated milk, whole and skimmed milk powder, ice-cream, butter, khoa, channa, paneer and similar products. Judging and grading of milk products. Cheese spreads by spray and roller drying techniques. EMC (Enzyme modified cheese), Enzymes in dairy processing. Insanitization viz. selection and use of dairy cleaner and sanitizer. In plant cleaning system. Scope and functioning of milk supply schemes and various national and international organizations. Specifications and standards in milk processing industry. Dairy plant sanitation and waste disposal.

UNIT VI: TECHNOLOGY OF MEAT / FISH / POULTRY PRODUCTS

Scope of meat, fish and poultry processing industry in India. Chemistry and microscopic structure of meat tissue. Ante mortem inspection. Slaughter and dressing of various animals and poultry birds. Post mortem examination. Rigor mortis. Retail and wholesale cuts. Factors affecting meat quality. Curing, smoking, freezing, canning and dehydration of meat, poultry and their products. Sausage making Meat tenderization and role of enzymes in meat processing. Utilization of by-products. Structure and composition of egg and factors effecting quality. Quality measurement. Preservation of eggs using oil coating, refrigeration, thermo stabilization and antibiotics. Packing, storage and transportation of eggs. Technology of egg products viz. egg powder, albumen, flakes and calcium tablets. Processing and preservation of fish and its products. Handling, canning, smoking and freezing of fresh water fish and its products.

UNIT VII: FOOD PROCESS EQUIPMENT DESIGN

Materials for fabrication, mechanical properties, ductility, hardness, corrosion, protective coatings, corrosion prevention linings equipment, choice of materials, material codes; Design considerations: Stresses created due to static and dynamic loads, combined stresses, design stresses and theories of failure, safety factor, temperature effects, radiation effects, effects of fabrication method, economic considerations.-Storage vessels - Operating conditions, design conditions - Design of shell and its component, stresses from local load and thermal gradient, mountings and accessories - Design of fermenter vessel and design problems - Hazards and safety considerations - Design of agitators and separators. Heat exchangers - 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 – Design of ice-cream freezers and refrigerated display system - Design of tray dryer, tunnel dryer, vacuum dryer, spray dryer and freeze dryer-Design of screw conveyor, bucket elevator and pneumatic conveyor - Design of extruders - Cold and hot extruder design, single and twin screw extruder.

UNIT VIII: FOOD GRAIN STORAGE

Importance of scientific storage systems – production and marketing of grain – storage scenario at warehouses - traditional and modern storages - Grain bulk ecosystem – biotic and abiotic variables and their interaction – major stored product insects – characteristics – chemical, enzymatic, biological and mechanical spoilages – grain deterioration and quality loss - Direct damages, indirect damages, causes of spoilage in storage (moisture, temperature, humidity, respiration loss, heat of respiration, sprouting) - destructive agents (rodents, birds, insects, etc.), sources of infestation and control. Storage of grain - respiration of grain, moisture and temperature changes in stored grain - conditioning of environment inside storage through ventilation - Traditional storage structures, improved storage structures, modern storage structures - Farm silos - Horizontal silos, tower silos, pit silos, trench silos, size and capacity of silos - Design of storage structures - Functional and structural design of grain storage structures, pressure

theories, pressure distribution in the bin, grain storage loads, pressure and capacities, warehouse and silos-Aeration and stored grain management - purposes of aeration, aeration theory, aeration system - design and operation – Fumigation – principles – properties and applications of fumigants.

UNIT IX: FOOD PACKAGING TECHNOLOGY

Factors affecting the choice of packaging materials - Interactions of spoilage agents with environmental factors as water, oxygen, light, pH, etc. - Functions of Packaging - Packaging requirement for raw and processed foods, and their selection of packaging materials - Packaging of foods, requirement, importance and scope, environmental considerations – Disposal and recycle of packaging waste. Plastic packaging, different types of polymers used in food packaging and their barrier properties - Paper and paper board packaging, manufacture process, modification of barrier properties and characteristics of paper/ boards - Corrugated fibreboard boxes, Relative advantages and disadvantages of different packaging materials - Testing methods for flexible materials, Tests for paper, thickness, bursting strength, breaking length, stiffness, tear resistance. Metal cans, manufacture of two piece and three piece cans– Coatings – Glass containers, types of glass used in food packaging, manufacture of glass and glass containers, closures for glass containers - Testing methods for rigid materials and semi rigid materials, Glass containers, visual defects, colour, dimensions, impact strength, etc. Metal containers, pressure test, product compatibility, etc. 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.

UNIT X: FOOD QUALITY MANAGEMENT

Objectives, importance and functions of quality control. Quality systems and tools used for quality assurance including control charts, acceptance and auditing inspections, critical control points, reliability, safety, recall and liability. The principles and practices of food plant sanitation. Food and hygiene regulations. Environment and waste management. Total quality management, good management practices, HACCP and codex in food. International and National food laws. US-FDA/ISO-9000 and FSSAI. Food adulteration, food safety. Sensory evaluation, panel screening, selection methods. Sensory and instrumental analysis quality control. Quality control of food at all stages and for packaging materials. Non destructive food quality evaluation methods.

32. DAIRY TECHNOLOGY (Degree Standard)

CODE: 456

UNIT I: MARKET MILK

Market milk industry in India and abroad: Collection and transportation of milk; a) Organization of milk collection routes b) Practices for collection of milk, preservation at farm, refrigeration, natural microbial inhibitors, lacto peroxidase system. Reception and treatment (pre-processing steps) of milk in the dairy plant: - Homogenisation: Standardization of milk – pearson square and algebraic methods Thermal processing of milk - Defects in market milk - Manufacture of special milks: toned, doubled toned, reconstituted, recombined, flavoured, homogenized, vitaminised and sweet acidophilus milk - Manufacture of sterilized milk, UHT-Distribution systems for market milk - Effect of heat processing on nutritive value.

Fat Rich Dairy Products: Cream-Butter-Ghee and butter oil Status of fat-rich dairy products in India and abroad. Cream: a) Definition & Legal standards, efficiency of cream separation and factors affecting it; control of fat concentration in cream. b) Neutralization, standardization, pasteurization and cooling of cream. c) Preparation and properties of different types of cream; table cream, sterilized cream, whipped

cream, plastic cream, frozen cream and chip-dips (cultured cream) d) Factors affecting quality of cream; ripening of cream e) Packaging, storage and distribution, defects (non-microbial) in cream and their prevention. Butter: a) Introduction to the butter making process; theory of churning, legal standards. b) Technology of Butter manufacture, Batch and continuous methods. Over-run in butter; control of fat losses in butter-milk; packaging and storage; transportation; defects in butter; rheology of butter; uses of butter. Butter making equipment: Construction, operation, care and maintenance of cream separators, coolers and vacuators, factory butter churn and continuous butter making machine. Special butters and related products: a) 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. b) Manufacture, packaging, storage and characteristics of margarine of different types. Ghee and butter oil: a) Methods of ghee making-batch and industrial processes, innovations in ghee production, procedure, packaging and preservation of ghee; utilization of substandard milk. b) Ghee: Composition and changes during manufacture fat constants. c) Butter oil: Manufacture of butter oil, packaging and storage.

Traditional Indian Dairy Products Khoa: Khoa based sweets: Burfi, Peda, Milkcake, Kalakhand, Gulabjaman and their compositional profile and manufacture practices. Rabri and Basundi: Channa: Channa-based sweets: Rasogolla, Sandesh, Rasomalai. Paneer: Chakka/Maska and Shrikhand: Misti Dahi: Kheer and Payasam: Bio preservative principles in enhancing the shelf-life of indigenous milk products including active packaging.

UNIT II: 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, their causes and prevention.

Dried Milks: Grading and quality of raw milk for dried milks, Manufacture of skim milk powder (SMP), whole milk powders 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, Management of condensed and dried milk industry. 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, Gouda, Swiss, Mozzarella, Cottage. Enzyme modified cheese (EMC), flavourings, Application of membrane processing in cheese manufacture. Factors affecting yield of cheese. Packaging, storage and distribution of cheese. Accelerated ripening of cheese. Manufacture of processed cheese, cheese spread and processed cheese foods. Mechanization and automation in cheese processing.

Ice-cream & Frozen Desserts Definition, classification, composition and standards of ice cream and other frozen desserts, Stabilizers and emulsifiers—calculation and figuring of ice cream mix and yield- their 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 shipping of ice-cream - Defects in ice cream, their causes and prevention.

UNIT III: PACKAGING OF DAIRY PRODUCTS

Characteristics of basic packaging materials: Paper (paper board, corrugated paper, fibre board), Glass, Metal, Plastics, Foils and laminates, retort pouches, Package forms, Legal requirements of packaging materials and product information. Packaging of milk and dairy products. Modern Packaging Techniques;

Vacuum Packaging, Modified atmosphere packaging (MAP), Eco-friendly packaging, Principles and methods of package - sterilization, Coding and Labelling of Food packages, Aseptic Packaging (AP) Microbiological aspects of packaging materials. Disposal of waste package materials, Packaging Systems. Hazards from packaging materials in food.

Sensory Evaluation of Dairy Products Terminology related to sensory evaluation. Design and requirements of a sensory evaluation laboratory. Basic principles: senses and sensory perception. Classification of tastes and odours, threshold value. Factors affecting senses, visual, auditory, tactile and other responses. Fundamental rules for scoring and grading of milk and milk products. Procedure and types of tests – difference tests (Paired comparison, due-trio, triangle) ranking, scoring, hedonic scale and descriptive tests. Panel selection, screening and training of judges. Requirements of sensory evaluation, sampling procedures. Milk: score card and its use. Judging and grading of milk-Cream-Butter- Ghee - Fermented milk products- Frozen dairy products: Cheese: cheddar, cottage and other varieties of cheeses. Dried dairy products: Dry milk products, evaporated and condensed milk, khoa and khoa based sweets, paneer, channa and channa based sweets.

UNIT IV: DAIRY PLANT MANAGEMENT

Production Management: Definition, Function and structure of Production Management, Production planning & Control, Work study and measurement motion and time study. Efficiency of plant operation: product accounting, setting up norms for operational and processing losses for quantity, fat and SNF, monitoring efficiency. Plant Operations: Energy conservation and Auditing, Product and process control, Control charts, Process Sigma, Efficiency factors, losses, Financial and Managerial efficiency. Provision for Industrial Legislation in India, particularly in dairy industry, Factory Act & Regulations. Human Resource Management: Safety hazards: hazards prevention, security for plant machinery and the employees, Plant Maintenance. Prevention & Break-down maintenance: Food hygiene: personnel hygiene, plant hygiene, water quality, etc.

Waste Disposal & Pollution Abatement Wastes discharged from dairy plants: An overview. Wastewater discharged from a) Milk reception dock, b) Liquid milk processing section, c) Butter and ghee manufacturing, d) Ice-cream and condensed milk manufacturing, e) Milk powder manufacturing, f) Cheese and paneer manufacturing, g) fermented milk products - Packaging wastes - Environmental issues in effluent discharge. Waste treatment process in a dairy processing plant: Wastewater treatment operations for a Dairy Processing Plant. Calculation of wastes discharged and the economics thereof.

UNIT V: DAIRY ENGINEERING

Sanitization: Materials and sanitary features of the dairy equipment. Stainless steel, Sanitary pipes and fittings, standard glass piping, plastic tubing, fittings and gaskets, installation, care and maintenance of pipes & fittings. Description, working and maintenance of can washers, bottle washers. CIP cleaning and designing of system – Selection of detergents and sanitizers – Effect of the sanitizers on the surfaces of the metals - Mechanical Separation - Homogenization:- Pasteurization: Care and maintenance of pasteurizers. Sterilization: Care and maintenance of Sterilizers. Packaging machines: Pouch filling machine pre-pack and aseptic filling bulk handling system Principles and working of different types of bottle filters and capping machine, Blow molding machines, Aseptic PET bottle filling machine. Cup filling system. Care and maintenance. Mixing and agitation: Theory and purpose of mixing. Equipment used for mixing solids, liquids and gases. Different types of stirrers, paddles and agitators.

Boilers and Steam Generation 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 in steam consumption. Steam generators - Introduction to Indian Boiler Regulation Act. Boiler Draught - Air Compressors.

UNIT VI: Dairy Process Engineering

Evaporation-Drying – Fluidization - Processing equipment-Mechanization and equipment used in manufacture of indigenous dairy products, Ice-cream and Cheese making equipment. Packaging equipment -milk & milk products. Membrane Processing: Ultra filtration, Reverse Osmosis and electro dialysis, Materials for membrane construction, Ultra filtration of milk, Effect of milk constituents on operation, membranes for electro- dialysis.

Refrigeration & Air-conditioning Basic refrigeration cycles and concepts-Refrigerants:Multi-Pressure Refrigeration Systems: Applications-Multi-evaporators with single stage and multi-stage compression and expansion systems – Refrigeration Equipment and Controls: - Refrigeration Piping: Purpose, Types, Materials, Fittings and Insulation. Design and Balancing of Refrigeration System- Absorption Refrigeration Systems-Cryogenic Freezing- Psychometry – Air - conditioning Systems. Cold Storage.

UNIT VII: ENERGY CONSERVATION AND MANAGEMENT

Introduction: Energy conservation Act 2001 and its important features, Schemes of Bureau of Energy Efficiency (BEE). Electricity Act 2003, integrated energy policy. Energy management & audit-Energy savings in transformers. Electric motor-selection and application, Energy efficient motors. Variable Speed Drives and Variable Frequency Drives (VFD) and their role in saving electric energy. Bureau of Energy Efficiency (BEE): Power saving guide with “Star Ratings” of electrical appliances: Induction Motors, Air conditioners, Refrigerators and Water Heaters. Industrial Lighting. High efficiency boilers, improved combustion techniques for energy conservation, Fluidized Bed Combustion and multi fuel capabilities. Energy conservation in steam distribution systems, efficient piping layouts, protective & insulation coverings in utility pipes. Steam conservation opportunities. Upkeep and maintenance of steam auxiliaries and fittings. Energy conservation in Refrigeration and AC systems (HVAC). Maintenance and upkeep of Vacuum lines and Compressed air pipe lines. Conservation and reuse of water, water auditing. Energy conservation opportunities in Wastewater treatment. Improving efficiency and energy conservation opportunities in Thermal processes, Evaporation, Drying & Freezing. Role of steam traps in energy saving. Energy Savings methods in hot air generator, Thermic fluid heater, Steam radiator. Carbon credits and carbon trade: Concepts of CDM, economic and societal benefits. Cleaner energy sources: Role of automation in conservation of energy in dairy and food processing: Incorporation of enhanced PLC based computer controls and SCADA.

Dairy Plant Design and Layout Type of dairies, perishable nature of milk, reception flexibility. Classification of dairy plants, Location of plant, location problems, selection of site. Hygienic design considerations for dairy processing plants. Planning-Dairy plant design aspects. Arrangement of different sections in dairy, siting the process sections, utility/service sections, offices and workshop. Arrangement of equipment, milk piping, material handling in dairies, Common problems, office layouts-flexibility. Building construction materials-Other design aspects: Drains and drain layout for small and large dairies. Ventilation, fly control, mold prevention, illumination in dairy plants. Computer aided Design: Introduction to CAD software.

UNIT VIII: CHEMISTRY OF MILK

Definition and structure of milk, factors affecting composition of milk, Casein: -Whey proteins: Hydrolysis and denaturation of milk proteins under different physical and chemical environments, Estimation of milk proteins and lactose -Importance of genetic polymorphism of milk proteins –Milk enzymes -Milk -milk lipids. Milk phospholipids -fat soluble vitamins, Milk Salts: Mineral in milk (a) major mineral (b) Trace elements-Milk Sampling techniques from different sources for chemical analysis -; Determination of titratable acidity, pH, fat percent, Total solids and SNF. Determination of casein, whey proteins and NPN in milk; Determination of lipase and phosphatase activity in milk; Determination of lactose and Ash content - Determination of temporary and permanent hardness of water; Estimation of available chlorine from bleaching powder.

Chemistry of Dairy Products Chemical composition and legal standards of milk products. Cream-Chemistry of creaming and factors affecting the same. Butter colour. Ghee: Physico-chemical changes during manufacture. Hydrolytic and oxidative deterioration, their causes, prevention and role of antioxidants. Physico- chemical changes in milk constituents during manufacture and storage of traditional dairy products: Khoa, Paneer, Dahi, Channa, Lassi, Chakka, and Shrikhand. Chemistry of cheese-Physico-chemical changes during preparation and storage of concentrated and dried milk products-Physico- chemical changes during processing and storage of ice cream and frozen desserts. Role and mechanism of stabilizers and emulsifiers in ice cream.

Chemical Quality Assurance Importance of chemical quality control, quality assurance and total quality management in dairy industry. Role of national and international food regulatory systems and standards with respect to quality and safety of milk and milk products: FSSAI, PFA, AGMARK, BIS ISO, IDF, Codex, etc., Application of food safety management system (ISO: 22000). Hazard analysis and critical control points (HACCP) Setting up of testing facilities and analytical laboratories; concept of mobile testing laboratories. Accreditation of analytical laboratories. Preparation and standardization of reagents required in the analysis of milk and milk products. Sampling procedures; labeling of samples for analysis; choice of analytical tests for milk and milk products for chemical analysis and instrumental methods of analysis. Calibration of dairy glassware; including butyrometer, pipettes, burettes, hydrometers, lactometers and thermometer. Testing methods for the detection of adulterants, preservatives and neutralizers in milk and milk products. Environmental contaminants such as pesticides, antibiotics, aflatoxin, heavy metals in milk and milk products and their chemical testing methods. Importance of milk contact surfaces, metallic contamination in dairy industry. Chemical quality of water in dairy industry. Prediction of shelf life behavior of milk and milk products.

UNIT IX: MICROBIOLOGY OF FLUID MILK

Microbes associated with raw milk: psychrotrophic, mesophilic, thermotolerant and thermophilic bacteria - Microbial contaminants in raw milk, their sources during various stages of production - Microbiological changes in bulk refrigerated raw milk. Sources of contamination and microbial spoilage of raw milk- Types of microbial spoilage - Mastitis milk - Concept of clean milk production: Microbiological quality of milk produced in organized and un-organized sector in India and comparative information in developed world; Microflora of aseptically drawn milk and its natural antimicrobial systems. Microbiological aspects of fluid milk: Significance of heat resistant and post processing contaminants in fluid milk with special reference to proteases and lipase enzymes and their role in spoilage of processed milk. Bio-film -Public health aspects of fluid milk: Microbial zoonotic diseases Milk borne diseases - Microbiological grading and legal standards of raw and processed milk.

Microbiology of Dairy Products Microbiology of Cream and Butter - Microbial Defects in butter - Microbiology of Condensed, Evaporated and Dried products: Microbial defects - Bacterial thickening / Mold button formation in SCM; Gassiness/bloating, Bacterial coagulation (Sour and sweet), Bitterness, Fishy flavor in evaporated milk; pre-heating/DSI temperature and their impact on microflora of dried products; Effect of reconstitution on microbial quality of milk powder including baby foods and survivability of pathogens; Regulatory microbiological standards. Microbiology of Ice Cream and Frozen desserts: Microbiology of Indigenous Milk Products: Predominance of spoilage and pathogenic organisms in khoa and khoa based sweets – burfi, peda, gulabjamun, etc., paneer, Chhanna and Chhanna based sweets – rasgulla; kheer, shrikhand, dahi, kulfi etc; Active packaging concepts and role in bio-preservation.

Starter Cultures and Fermented Milk Products Types, metabolism and propagation of starter cultures-Propagation of starter cultures-concentrates - direct bulk and direct vat starter cultures, - Metabolism of starter cultures (carbohydrate, protein, citrate) and production of metabolites and antibacterial substances; methods of starter distillates their merits/demerits. Activity, Purity, Preservation of Starters and Starter Failure -Defects in starters and their control; Starter failures- effect of antibiotic residues, sanitizers and

bacteriophages. Role of Starters in fermented milks: - Curd, Yoghurt, Shrikhand, Kefir and komiss, Bulgarian milk, cultured buttermilk, Leben, Villi and Yakult; Cheese Starters; Rennet.

UNIT X: FOOD BIOTECHNOLOGY

Chemical nature of the genetic material, properties and functions of the genetic material, organization of the genetic material in bacteria, eukaryotes and viruses; DNA replication: Replication fork, DNA polymerases, other enzymes and proteins required for DNA replication, origin of replication, replication of circular DNA molecule; Transcription and translation: RNA synthesis, types of RNA, genetic code; Mutation and DNA repair, mechanisms of repair of damaged DNA (photo reactivation, excision repair, recombination repair, SOS repair, mismatch repair), transposable elements, plasmids, Expression of foreign genes; Promoter enzymes; Recombinant DNA technology: Restriction enzymes, cloning vectors, cloning procedure, cloning of specific gene and their identification (colony hybridization, C-DNA, southern blotting, polymerase chain reaction); Gene cloning: Biosensors: -Application of biotechnology in food: Immobilization of enzymes: GM foods: Testing for GMOs, current guidelines for production, release and movement of GMOs, labeling and traceability, trade related aspects, bio-safety, risk assessment, risk management, public perception of GM foods, IPR, GMO Act 2004.

Quality and Safety Monitoring in Dairy Industry Consumer Awareness about Microbiological Quality and Safety of Dairy Foods: FSSAI Regulation and Acts for Milk and milk products – Introduction to Food Safety Management System ISO 22000: Concepts of Quality Management System - Principles of QMS; Standard requirements for QMS; HACCP concept and principle with special reference to biological hazards in dairy foods, TQM tools and techniques - Export stipulations - Microbiological Risk Analysis Concepts: Bio-safety concepts in handling of dairy pathogens and setting up of a microbiological/ pathogen lab in a dairy plant. Rapid Enumeration Techniques: for rapid detection of pathogens like E.coli (E.coli 0157:H7), Salmonella, Shigella, Staphylococcus aureus, Bacillus cereus and Listeria monocytogenes. Role of Biosensors for monitoring hygiene and safety of dairy foods: Detection of mastitic milk, antibiotic residues in milk, aflatoxins M1 & M2 –Delvo SP, MDR test, penzyme test, charm assay, lateral flow assay (ROSA test) etc. Detection of aflatoxins, pesticides other inhibitors etc. and their public health importance in dairy foods.

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CODE: 460

UNIT I: PROTEINS

Proteins - Classification based on solubility, nutrition & functions. Protein structure - Primary, secondary (helix and pleated sheet), tertiary and quaternary structures of protein. Amino acids - Structure & classification. Essential and non-essential amino acids. Peptides: structure of peptide bond. Denaturation and renaturation of proteins.

Biosynthesis of nonessential amino acids. Catabolism of amino acid nitrogen- transamination, deamination, ammonia formation and the urea cycle. Catabolism of carbon skeletons of amino acids. Conversion of amino acids to special products. Disorders of amino acid metabolism - phenylketonuria, alkaptonuria, albinism, and maple syrup urine disease. Biosynthesis and degradation of porphyrins and heme. Porphyrias.

Major milk proteins: caseins (acids and micellar), physico-chemical properties, casein micelle models. Alpha-Lactalbumin and beta-lactoglobulin, lactoferrin, bovine serum albumin.

UNIT II: LIPIDS

Fatty acids - saturated, unsaturated and hydroxy fatty acids. Phospholipids and glycosphingolipids - structure and biological functions. Steroids - animal sterols. Structure, properties and functions of

cholesterol. Lipoproteins - classification and composition. Amphipathic lipids (membranes, micelles, emulsions and liposomes).

Oxidation of fatty acids - role of carnitine in fatty acid transport, α , β and ω - oxidation. Metabolism of ketone bodies. Biosynthesis of fatty acids - Fatty acid synthase complex - regulation of lipogenesis. Metabolism of triglycerides, phospholipids and sphingolipids. Cholesterol - biosynthesis, regulation, transport and excretion. Metabolism of lipoproteins and lipoproteinemias. Metabolism of prostaglandins - COX and LOX pathways. Lipid storage diseases and fatty liver.

Milk lipids: classification and physical properties. Auto-oxidation, secondary products of auto oxidation, factors affecting, prevention and measurement; Antioxidants – enzymatic and non-enzymatic antioxidants.

UNIT III: CARBOHYDRATES, MINERALS AND VITAMINS

Carbohydrates: classification and characteristics of different carbohydrates. Cellulose, glycogen, hemicellulose and pectin. Production of dextrans and malto dextran. Aldoses and ketoses. Epimers. Lactose: occurrence, isomers, molecular structure. Milk oligosaccharides, structural, technological aspects and health promoting aspects.

Overview of glycolysis and gluconeogenesis- Regulation. The citric acid cycle and regulation. The pentose phosphate pathway and uronic acid pathway. Metabolism of glycogen and regulation. Glycogen storage diseases. Galactosemia. Fructose intolerance and fructosuria. The glyoxylate cycle. Cori cycle. Photosynthesis- light reaction, cyclic and noncyclic photophosphorylation. Dark reaction- Calvin cycle.

Minerals: major and minor minerals. Water soluble vitamins: thiamin; riboflavin; niacin; pantothenic acid; pyridoxine; biotin; folacin and cyanocobalamin. Fat soluble vitamins - Vitamin A and D.

UNIT IV: ENZYMES

Enzymes - Classification and general characteristics. Effect of pH, temperature and substrate concentration. Enzyme inhibition – Effect of competitive, uncompetitive and non-competitive inhibitors. Coenzymes and cofactors. Regulation of enzymes – feed back inhibition and covalent modification. Abzymes, ribozymes, DNA enzymes.

Immobilized enzymes- methods of immobilization, applications. Enzyme Engineering with reference to T4 lysozyme. Enzyme electrode. Industrial and Clinical Enzymology: Enzymes of industrial and clinical significance, sources and applications of amylases, protease and lipases. Therapeutic use of asparaginase. Streptokinase. Enzymes and isoenzymes of diagnostic importance. LD, CK, transaminases, phosphatases and amylase. Enzyme patterns in diseases - liver disease and myocardial infarction. Indigenous milk enzymes:

UNIT V: BIOENERGETICS, BIOLOGICAL OXIDATION & APOPTOSIS

Free energy and entropy, endergonic and exergonic reactions Phosphoryl group transfers and ATP. Enzymes involved in redox reactions. The electron transport chain - organization of respiratory chain complexes and electron flow. Oxidative phosphorylation - electron transfer reactions in mitochondria. F1F0 ATPase - structure and mechanism of action. The chemiosmotic theory. Inhibitors of respiratory chain and oxidative phosphorylation - poisons, uncouplers and ionophores. Regulation of oxidative phosphorylation. Mitochondrial transport systems - ATP/ADP exchange, malate/glycerophosphate shuttle, creatine phosphate shuttle. Mitochondrial membrane potential, Apoptotic cell death – Intrinsic and extrinsic signal transduction pathways, ferroptosis and necrosis. Cell cycle analysis, cell survival metabolic assays.

UNIT VI: CELLULAR BIOCHEMISTRY

The cytoskeleton - microtubules, microfilaments and intermediate filaments. Types of tissues. Major classes of cell junctions - anchoring, tight and gap junctions. Major families of cell adhesion molecules (CAMs) - cadherins, integrins. Composition of membranes - the lipid bilayer, peripheral and integral proteins. Endocytosis and exocytosis. Membrane transport: types. Diffusion - passive and facilitated. Active transport - primary and secondary. The P-type ATPases, F-type ATPases, ionophores, aquaporins, ion channels. Stem cells: types, isolation, identification, expansion, differentiation and uses, stem cell engineering, ethical issues. Animal cell culture: Primary cell culture: disaggregation, separation of viable cells. Secondary culture maintenance of cell lines. Cancer cell lines. 3D culture. Scaffold preparation and organogenesis. Large - scale cell cultures. Commercial applications of animal tissue culture.

Fundamental concepts and general features of cell signaling. Types of receptors. Transmembrane, nuclear and cytosolic receptors. G-protein coupled receptors. Second messengers: c-AMP, cGMP, diacylglycerol, inositol triphosphate and Ca^{2+} . Receptor tyrosine kinases - insulin signalling, ras- raf-MAP kinase and JAK-STAT pathways. ATM signalling pathways. Antisense RNA and RNA interference. Epigenetic gene regulation: DNA methylation, histone acetylation and deacetylation.

UNIT VII: IMMUNOTECHNOLOGY

Antigens and Antibodies Central and peripheral lymphoid organs. antigenicity, antigenic determinants, haptens and epitopes. Antibodies - structure, classification, functions. Types of immunity - innate and acquired immunity, Antigen recognition - T-cell and B-cell receptor complexes, antigen processing and presentation. Interaction of T and B-cells. Immunological memory, Effector mechanisms: phagocytosis, cell mediated cytotoxicity, antibody dependent cell mediated cytotoxicity. Vaccines-killed, attenuated organisms, toxoids, recombinant vaccines, subunit vaccines, DNA vaccines, synthetic peptide vaccines, antiidiotypic vaccines. Antibody diversity - mechanisms contributing to diversity- somatic recombination, rearrangement and generation of antibody diversity. Class switching. MHC complex- gene organisation - HLA genes class I and II antigens. Histocompatibility testing, cross matching. MHC & disease association. Transplantation-types - Graft versus host reactions. Immunosuppressive agents. Hypersensitivity - definition and classification - type I to type V (brief account only). AIDS- pathogenesis, diagnosis and treatment. Tumor immunology - immune surveillance, tumor antigens, immune response to tumors, cancer immunotherapy.

UNIT VIII: MOLECULAR BIOLOGY

The central dogma of molecular biology. Eukaryotic chromatin: nucleosomes, 30 nm fiber and higher order chromatin structure. Enzymes and proteins involved in replication: helicases, SSB, topoisomerases, DNA polymerases, DNA ligase. DNA replication in bacteria and eukaryotes. Inhibitors of replication. DNA damage by physical and chemical agents. DNA repair - photoreactivation, excision repair, mismatch repair, double strand break repair. Molecular biology of homologous recombination. Transposons: mechanism of transposition and applications. RNA polymerase subunit structure, promoter sequence steps in transcription - template recognition, initiation, elongation and termination (intrinsic, rho-dependent). Transcription in eukaryotes: RNA pol I, II and III: subunit structure, transcription factors, promoters, inhibitors. Mechanism of RNA pol II transcription: preinitiation complex formation, transcription initiation (activator proteins, mediator, chromatin recruitment), elongation, termination. Classes of introns. Post-transcriptional processing of prokaryotic and eukaryotic rRNA, and tRNA. and eukaryotic mRNA. Brief account of ribozymes, RNA editing and Reverse transcription. point mutations and frameshift mutations. Suppressor mutations - nonsense and missense suppression. Mechanism of protein synthesis in bacteria and eukaryotes: amino acid activation, initiation, elongation and termination. Inhibitors of protein synthesis.

UNIT IX: BIOCHEMICAL TECHNIQUES

Absorption spectrum. Principle, instrumentation and applications of UV- visible spectrophotometry, spectrofluorimetry and luminometry. Atomic spectroscopy-principle and applications. NMR and ESR, ORD and CD. Autoradiography. Applications of radioisotopes in biology. Microscopy- basic principles, and components of light, bright field, phase contrast, and fluorescence microscopy. Electron microscopy - principle, preparation of specimens for TEM and SEM. Confocal microscopy. Atomic Force Microscopy (basic concepts). Electrophoresis - SDS-PAGE, isoelectric focusing, 2-D PAGE. Agarose gel electrophoresis, pulsed-field gel electrophoresis. Blotting techniques: Southern, Northern and Western blotting techniques. Chromatography - adsorption chromatography, gas chromatography, ion exchange, molecular exclusion, and affinity chromatography, HPLC, Analytical and preparative ultracentrifuge. Subcellular fractionation by differential centrifugation.

UNIT X: GENOMICS, PROTEOMICS AND BIOINFORMATICS

Genome Mapping and Sequencing Definition of genome and genomics. Molecular markers for mapping- RFLPs, microsatellites and SNPs. Physical mapping Chromosome walking and jumping. Whole-genome shotgun, hierarchical shotgun. Next-Generation Sequencing. Exome sequencing. ORF scanning. The Human Genome Project. DNA microarrays, transcriptomics, ChIPs, knock-out analysis, genome editing – CRISPR/Cas9. Liquid-liquid chromatography. Edman degradation, mass spectrometry-basic principle and instrumentation, ESI, MALDI-TOF, SELDI-TOF, tandem MS. Peptide mass fingerprinting. Structural proteomics - X-ray and NMR for protein structure analysis. Comparative and homology modeling, secondary structure prediction, fold recognition and ab initio prediction. SCOP. Protein sequence analysis: Protein function determination: database search for homology. Protein-protein interactions: yeast 2 hybrid system, protein arrays and chips. Applications of proteomics. Bioinformatics workstation, Biological databases. Data submission and retrieval. Sequence alignment: substitution scores and gap penalties. BLAST, FASTA. Multiple sequence alignments: CLUSTAL. Gene discovery and prediction. Molecular phylogenetics: Identification of orthologs and paralogs. Protein structure database-protein structure visualization, comparison and classification.

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CODE: 461

UNIT I:

CELL AND MOLECULAR BIOLOGY:

Analysis of STR, Analysis of other configurations, Bioreactor scale-up, Modeling and simulation of Bioprocesses, Bioreactor considerations in Enzyme systems. Cells, Cell lines, Cell culture, Cell Organelles and its functions, types of Cell divisions, cell cycle and its regulation mechanism. Transport mechanism (Passive, Active, ATPase pumps and Na⁺/K⁺ Pumps), receptors, signal Transduction, models of signal Amplification Secondary messengers, Structure of Nucleic Acids, Replication, Transcription, Translation and DNA repair mechanism in Prokaryotes and Eukaryotes. Promoters, Enhancers and Transcription factors. Genetic Codes and lac & trp operons. BIOCHEMISTRY AND MICROBIOLOGY: Structure, function and metabolism of carbohydrates, lipids, Nucleic Acids and proteins. Enzymes and its mechanism. Electron Transport Chain system, High energy compound and reducing equivalents. History of Microbiology, Classification of Microorganism, structural organization and multiplication of microorganism. Physical and chemical control of microorganisms, primary and secondary metabolites and their applications.

GENETIC ENGINEERING:

Genes, control gene expression, restriction enzymes, vectors (prokaryotic and eukaryotic) construction of DNA and genomic library.

FOOD CHEMISTRY & NUTRITION:

Carbohydrates, Protein & Lipids and its functional properties, Pigments, Food flavours, Enzyme activity, enzymatic and non-enzymatic browning. Nutrition: balanced diet, essential amino acids and essential fatty acids, water soluble and fat soluble vitamins, role of minerals in nutrition, co-factors, anti-nutrients, nutraceuticals, food acids, moisture relations in food, Chemical and biochemical changes during processing and storage. Food Additives, Role of JECFA in safety assessment of food additives, definition, chemical structure, role in food processing and product end characteristics, Nutritional disorders, Diet therapy, probiotic and prebiotic foods, Therapeutic, organic foods, nutraceutical and functional foods.

FOOD MICROBIOLOGY, FOOD ANALYSIS, SAFETY & QUALITY MANAGEMENT:

Characteristics and morphology of microorganisms, Microbial growth, Importance of microorganisms in food – primary sources in food – intrinsic and extrinsic parameters of food affecting microbial growth – Microbial spoilage of foods, Fermented and microbial foods – Food borne diseases and safety, Toxins from microbes, natural contaminants and health hazards associated with foods. Food analytical methods, statistical evaluation of analytical data, Principle and methods for subjective and objective quality evaluation of foods, Measurement techniques and instruments for food quality determination, destructive and non – destructive evaluation, International & National Food laws and standards.

DAIRY MICROBIOLOGY:

New Microorganisms associated with milk & milk products. Hygienic milk production methods for milk preservation. Microflora of raw milk. Effect of processing treatments of the microflora of raw milk. Mastitis milk and its suitability for dairy processing. Starter culture technology. Microbiological Quality Control of the Dairy Plant: The HACCP concept. Sanitation of Dairy Plant equipment & environment. Importance of microbiological quality of water. Microbiological testing of milk & milk products. (Diseases transmitted via milk & milk products). Microbiological standards recommended for milk & milk products. Introduction to Aseptic Techniques.

UNIT II:

FOOD PRODUCT PROCESSING & PRESERVATION TECHNOLOGY:

High temperature processing, Use of non-thermal technologies for preservation Properties, Processing and Preservation of milk and milk products, fermented foods, Value addition and by products utilizations.

FOOD ENGINEERING, PROCESS CONTROL & FOOD PACKAGING:

Heat transfer, momentum transfer, mass transfer, Unit operations, membrane separation processes, mechanical separation process, thermal operations, thermodynamics, Refrigeration – principles and applications, cold chain logistics, Engineering properties of food, food plant equipment design, Static and dynamic response, advanced control systems, Instrumentation.

PACKAGING SYSTEMS AND METHODS:

Bag – in box; microwave packaging; retort pouch technology, active packaging; intelligent packaging, antimicrobial packaging; bio-degradable packages, non-migratory bioactive polymers (NMBP) in food packaging - types and applications; application of nanotechnology in laminates, edible packages; bacterial production of polymer, packaging-flavour interactions, factors affecting flavour absorption, effect of irradiation of polymeric packaging material on the formation of volatile compounds, protective packaging of foods; packaging of food products sensitive to oxygen, light, moisture. Case studies: packaging and lipid oxidation, modelling lipid oxidation and absorption shelf life evaluation of packaged food, package characterization and testing; time – temperature indicators (TTIs), defining and classifying TTIs, requirements for TTIs.

PACKAGING MATERIAL CHARACTERIZATION AND EQUIPMENT:

Paper and paperboard – raw materials, manufacturing stages, pulping techniques, types of paper, specialty papers; glass – types of glass, properties, glass manufacturing, bottle forming process & designs, usp; cartons – designs, manufacturing, applications, corrugated fibre boards, fibre drums; plastic –

classification, glass transition, melting, degradation temperature, properties of plastic – PE, PP, PS, PVC, EVA, PA, EVOH, PLA and others; metals in packaging and their properties; container cleaning – air blast, ionized air blast, water rinse, wash and rinse, aggressive wash and rinse, sterilization, bottle orienting systems. Filling equipment and method - solid, liquid, semi - solid food -types of fillers - filler for glass bottle, paper bottle, pouches, plastic cup thermoforming equipment; form-fill - seal equipment, sealing equipment, labelling, and capping, canning and cartoning equipment. industrial packaging: unitizing – shrink and stretch wrapping, palletizing, containerizing, rigid and semi-rigid containers; thermoformed packages – skin packaging and blister packaging; flexible containers; form – fill - seal system.

STRUCTURAL AND GRAPHIC DESIGN IN FOOD PACKAGING:

Information required before designing a package for food product: product, targeted consumers marketing a product, branding requirements, style of packaging, budget – steps in designing of food packaging. Creating information architecture for printing, evaluation of packaging design, reuse of containers; child resistant package - design of security features, barcodes, RFID vision/inspection, metal detectors and x-ray inspectors, smart tracking systems, case study. Graphic design: typography, color, illustration, marketing studies, package aesthetics, decoration aspects. Closure design: function, types, selection considerations, closure dimensioning, metal closures, closure seals, plastic closures, injection moulds and closure design, tamper evident closures, child resistant closures. Special closures and functions.

PACKAGING OF FRESH FOODS:

Food packaging laws and regulation, food labelling, packaging requirements for different foods and processing methods - general classification and packaging types, varieties and trends; packaging of convenience foods; packaging of food products – fresh fruits and vegetables, packaging of fruit juices, packaging of jams and jellies, packaging of pickles and chutneys, packaging of fats and edible oils, packaging of break - fast cereals, packaging of tea, coffee & other beverage products; packaging of soft drinks; packaging of bakery products - bread, biscuits & cakes; packaging of snack foods; packaging of ready – cook products; packaging of spices, condiments, oleoresins.

PACKAGING OF PROCESSED FOODS:

Packaging of meat and poultry products; packaging of fish and other sea - foods; packaging of dairy products; packaging requirements for thermal - processed, dehydrated, frozen, irradiated and other specially processed foods - packaging for defence food, space food, high energy food for high altitude, functional foods, recent trends and advancements in food packaging.

UNIT III:

INSTRUMENTATION AND ANALYTICAL TECHNIQUES HPLC ANALYSIS OF FOOD:

HPLC analysis of food: HPLC (High performance liquid chromatography). Introduction, principle of separation, components of an HPLC system. Pump, injector, column (column hardware and column packing materials in brief) detector and different types of detectors, recorder, Application of HPLC, Minimum Response, Performance level- operation quotient and performance quotient.

GCMS ANALYSIS OF FOOD:

Gas Chromatography: Gas chromatography Introduction, sample preparation, principle of separations, components gas supply system, injection port, oven, column and stationary phases, types of columns, detectors different types of detectors, recorder, types of carrier gases used. Gas liquid chromatography: principle; different types of detectors and its applications: discharge ionization detector (DID), electron capture detector (ECD), flame photometric detector (FPD), Hall electrolytic conductivity detector (EICD), helium ionization detector (HID), Nitrogen phosphorous detector (NPD), mass selective detector (MSD), photo ionization detector (PID), pulsed discharge ionization detector (PDD), thermal energy analyzer (TEA); various applications of GLC. Gas chromatography-mass spectrometry (GC- MS): principles and applications in foods, flavors and fragrances, residue analysis of veterinary hormonal substances and endocrine disruptors, identification of terpenes.

LCMS ANALYSIS OF FOOD:

Liquid chromatography-mass spectrometry (LC-MS): principles and applications, plant phenols, proteins, proteomics, LC-MS for identification of post-translational modifications, oligosaccharides, lipids and phospholipids, nucleic acids. Inductively coupled plasma atomic emission spectroscopy (ICP/MS/OES/AES): principles and its applications. Scanning Electron Microscopy principles and applications, study of the structure of variety of food gels.

NON DESTRUCTIVE TECHNIQUES IN FOOD ANALYSIS:

Non Destructive Techniques in Food Analysis: optical methods like visible, NIR, and FTIR spectroscopy; computer vision, delayed light emission and fluorescence; X-ray imaging for classifying food products based on internal defects; nuclear magnetic resonance techniques; ultrasonics; firmness measurement methods; linear visco-elastic methods; biosensors in food quality evaluation, new techniques for food quality data analysis and control. MICROBIAL TECHNIQUES IN FOOD ANALYSIS: Microbial techniques in food analysis: Infectious and toxigenic agents of food borne diseases: detection, identification and control methods. Antibiotic resistant strains; methods of detection, conventional, modern, rapid methods, genetic approaches. Molecular based techniques in food analysis: Gel Electrophoresis of Plasmid DNA, Polymerase Chain Reaction (PCR) & Sequencing; Setting up a Gene-Specific Polymerase Chain Reaction, Gel Electrophoresis of Gene-Specific PCR Products, Determining DNA Concentration Using Fluorometer, Amplification of cDNA Using PCR, Sequencing of Gene- Specific Products. Real-time PCR assay for detection of microbial spoilage of foods.

UNIT IV:

PROPERTIES OF STEAM:

Introduction, Formation of Steam, Total Heat (or Enthalpy) of Water, Latent Heat of Steam, Dryness Fraction, Wetness Fraction, Total Heat (or Enthalpy) of Wet Steam, Total Heat of Superheated Steam, Advantages of Superheating Steam Use of Steam Tables, Specific Volume of Steam, Volume of Superheated Steam, External Work Done during Evaporation, Internal Energy of Steam, Entropy of Waters, Entropy of Evaporation's Entropy of Wet Steam sg, Entropy of Superheated Steam, Temperature Entropy Diagram for Water and Steam, Isothermal Lines on Temperature Entropy Diagram, Adiabatic Lines on the Temperature Entropy Diagram, Mollier Diagram or Total Heat Energy Chart for Steam, Methods of Heating and Expanding the Steam, Determination of Dryness Fraction of Steam. Type of Steam.

BOILERS:

Definition, Classification of Boilers, Comparison of Fire Tube and water, Tube Boilers, Essentials of a Good Boiler, Factors Affecting Boiler Selection, Simple Vertical Boiler, Fraser Culman Boiler, Cochran Boiler, Lancashire Boiler, Cornish Boiler, Locomotive Boiler, Nestler Oil Fired Boiler, Babcock and Wilcox Boiler, Stirling Boiler, High Pressure Boilers, The Benson Boiler, The Loeffler Steam Generator, The Volex Steam Generator, La Mont Boiler, Boiler Mountings, Boiler Accessories, Steam Driers or Separators, Steam Trap, Pressure Reducing Valve.

MILK PROCESSING:

Composition of milk, physical, chemical and biological properties of milk. Processing of market milk: Practices for reception, chilling, clarification, and storage of raw milk. Homogenization of milk: Definition, pre-treatment of milk for homogenization, theories of homogenization, synchronization of homogenization with HTST plant. Effect of homogenization on physico-chemical properties of milk. Bactofugation. Thermal Processing of Milk: Principles of thermal processing, kinetics of microbial destruction, thermal death curve, Arrhenius equation. Terminology's used in thermal processing, 'D-value', 'Z- value', 'Q 10-value', 'Fo-value'. Process description and definitions: Thermization, Pasteurization, Sterilization, UHT processing. Thermization: significance and methods. Pasteurization methods: LTLT/HTST, vaporization, stassanization. Manufacture of special milks: Reconstituted/recombined milks, Flavoured milks, homogenized/ vitaminized milks. Lactose-hydrolysed milk.

UNIT V:

QUALITY CONTROL IN DAIRY INDUSTRY:

Importance of chemical quality control in dairy industry, setting up quality control laboratories and testing facilities, mobile testing laboratories. Sampling procedures; labelling of samples for analysis; choice of

analytical tests for milk and milk products for chemical analysis; instrumental methods of analysis. Calibration of dairy glasswares including butyrometers, pipettes, burettes, hydrometers, lactometers and freezing point thermometer. Preparation and standardization of reagents required in the analysis of milk and milk products. Legislation on production, transport, processing and marketing of milk and milk products: application of FSSAI, Agmark BIS, IDF, ISO, IPO and international sanitary regulations related to dairy products to the quality control of milk and milk products. Dairy effluents and their recycling. "Prediction of shelf-life behaviour and quality assurance in milk and milk products. Selection of tests for microbiology analysis of milk and milk products and their interpretations: Rapid methods of milk testing: Non culture methods. Organizational aspects of microbiological quality of dairy products. Role of various agencies in the formulation of standards and controlling quality of dairy products. Various microbiological standards of BIS, FSSAI, ISO, CCDS for dairy products. Quality of dairy water supplies and purifications procedure and waste disposal. Treatment and disposal and wastewater and effluent. Dairy products borne infection and intoxications and public health significance. Microbial toxins in dairy products and their significance in public health. Detection and control measures. Indicator organisms and their significance in dairy products: Faecal and non-faecal coliform including faecal streptococci. Total gram negative bacteria including Salmonella and Shigella group. Predictions of shelf life behaviour and quality assurance in UHT processed/sterilized milk and milk products.

UNIT VI:

FOOD PROCESS AUTOMATION:

Food quality, automated evaluation of food quality, food quality quantization and process control, typical problems in food quality evaluation - beef quality evaluation; food odor measurement, continuous snack food frying quality. Data acquisition: Sampling elaboration with examples, concepts and systems for data acquisition such as: ultrasonic signal acquisition for beef grading, electronic nose data acquisition for food odor measurement, snack food frying data acquisition for quality process control, Image acquisition: elaboration with examples.

DATA ANALYSIS: Data pre-processing, Static data analysis, Dynamic data analysis, Image processing: Image segmentation, Image feature extraction etc. **MODELLING:** Modelling strategies: Theoretical and empirical modelling, Static and dynamic modelling, Linear statistical modelling, ANN modelling etc

PREDICTION:

Prediction and classification, Sample classification for beef grading, examples such as, based on linear statistical and ANN models, Electronic nose data classification for food odour pattern recognition, Snack food classification for eating quality evaluation based on linear statistical and ANN models, One-step-ahead prediction.

CONTROL:

Process control, internal model control, Predictive control, Neuro-fuzzy PDC for snack food frying process, Systems integration: Food quality quantization systems integration, Food quality process control systems integration, Food quality quantization and process control systems development.

UNIT VII:

DAIRY TECHNOLOGY PROCESSING AND STORAGE OF MILK:

Introduction –Composition and Physico-chemical properties of milk and milk constituents – LP system, microbiology of milk and Quality assurance. Milk reception – Cooling methods- Transportation and Storage of milks. Quality determination and grading of milk. Cleaning and disinfection of transport, storage facilities and handling equipments. Milk processing - terminologies – Process flow diagram. Pasteurization – principles and objectives – methods– sterilization – UHT processed milk products, their properties and prospects, types of UHT plants. Equipments and working principles, hybrid technology for pasteurization of milk, microwave processing of milk.

OPERATIONS AND MILK PRODUCTS: Cream separation – principles – gravity and centrifugal separation – equipments and working principles. Homogenization – theory - effect on milk - working principle of homogenizers - Principles and equipment for bacto-fugation and Bactotherm processes, Microfluidization of milk: Principle, equipment, effects and applications, Cleaning and sanitization - CIP cleaning - bottle fillers and cappers- form fill seal machines— aseptic filling Recombined milk – fluid milk - standardized - toned - reconstituted milks. Special Milks - Soft curd milk – Flavoured milk - Vitaminized milk – sterilized milk - irradiated milk. Condensed milk PFA/BIS requirements of sweetened condensed

milk - standardization. Evaporated milk- manufacturing technology - defects and remedies. Fermented Milk Products – Yoghurt- Acidophilus milk – technology and microbiology. Cheese – varieties - manufacturing methods.

ENZYME AND MICROBIAL INFLUENCE IN MILK PRODUCTS: Microbial rennet and recombinant chymosin, characteristics and application in cheese making; exogenous free and microencapsulated enzymes, immobilized enzymes-their application in accelerated ripening of cheese; enzymatically modified cheeses (EMC) their utilization in various food formulations. Technological requirements of modified micro-organisms for production of cheese and fermented milk products; technological innovations in the development of functional dairy foods with improved nutritional therapeutic and pro- biotic attributes; physiologically active bio-peptides/ nutraceuticals.

BY PRODUCTS AND ITS PROPERTIES: Protein hydrolysates – their physicochemical, therapeutic properties, production and application in food formulations; production of bio-yoghurt, probiotic cheese and fermented Milks; bifidus factors in infant food formulations their physicochemical, therapeutic properties, de-bittering and application in food formulations; Enzymatic hydrolysis of lactose for preparation of whey and UF-permeate beverages. Vegan foods. Microbial polysaccharides their properties and applications in foods, production of alcoholic beverages and industrial products from starch; whey and other by- products; bio-sweeteners types properties and their applications in dairy and food industry.

SHELF LIFE PARAMETERS AND PRESERVATION: Bio-preservatives- characteristics and their application in enhancing the shelf life of dairy and food products. Practical Effect of exogenous enzymes on hydrolysis of protein and fat in culture containing milk systems; to study the various factors affecting the coagulation of milk by microbial rennets. Manufacture and evaluation of pro-biotic cheese and fermented milks; determination of glycolysis, proteolysis and lipolysis in cheese and fermented milk; enzymatic process for manufacture of low lactose milk whey products; preparation of casein hydrolysis; visit to a bio-processing unit. Current trends in cleaning and sanitization of dairy equipment: biological; detergents; Automation; Ultrasonic techniques in cleaning; bio- detergents, development of sanitizers-heat; chemical; radiation, mechanism of fouling and soil removal; Bio-films, assessing the effectiveness of cleaning and sanitization of dairy products.

UNIT VIII:

FOOD LEGISLATION AND STANDARDS INDIAN FOOD REGULATIONS: Need for food regulation, Food Safety and Food Standards Act 2006, Food Safety and Standards Authority of India (FSSAI) structure and functions, scientific committees and panels under FSSAI, Rule and Regulation making process. Food Safety and Standards Act, 2006 and the regulations made thereunder like Licensing and Registration, Packaging and Labelling Regulation, Food Products Standards and Food Additives Regulation, Nutraceutical Regulation, Claim Regulation, Contaminants and Toxins Regulation.

PRODUCT SPECIFIC INDIAN REGULATIONS: Indian Food Regulation - Food product categorization, Use of food additives in different products, Processing aid regulation New product /additive approval Food Product Recall, BIS mandatory certified products, Packaged Commodity Rules, AGMARK, etc., including latest amendments.

INTERNATIONAL FOOD REGULATIONS: Concepts and trends in food legislation, Information-Domination in the European Food Industry, Agriculture, Ethics and Law, WHO in Global Food Safety Governance, The Right to Food in International Law with Case Studies. Intellectual Property and Food Labelling: Trademarks and Geographical Indications, Agricultural Innovation: Patenting and Plant Variety Rights Protection, Cross- Contamination, Genetic Drift, and GMO Co-existence with Non-GM Crops, Legal Barriers to International Food Trade, food policies.

PUBLIC HEALTH AND NUTRITION REGULATION: Roles on Nutrition Goals and Outcomes: Connecting of Food and Public Health Systems, Planetary Boundaries in Food and Agriculture Law, Food and Nutrition in Cancer Prevention and Treatment, Pesticides and Cancer in Conventionally- Grown Versus Organic Food.

FOOD SECURITY AND SAFETY LEGISLATION: Internalizing Externalities: Techniques to Reduce Ecological Impacts of Food Production, Cooperatives and Producer Organizations Roles in Achieving

Food Security, Governing the Global Food System towards the Sustenance with Artificial Photosynthesis. Food Safety and Policy, Trade, Labelling Law - European Food Law, United States and Canada, Australia and New Zealand, Africa, Asia, Association of Southeast Asian Nations (ASEAN).

UNIT IX:

FOOD PRODUCT DESIGN AND DEVELOPMENT FOOD NEEDS & CONSUMER PREFERENCE:

Market survey and its importance in; designing a questionnaire to find consumer needs for a product or a concept; advantages of processed foods in urbanised Modern Society; why people buy processed foods. Developing a Product to Meet the Requirements.

DESIGNING NEW FOOD PRODUCTS: New Food Product Development (NPD) process and activities, NPD success factors, new product design, food innovation case studies, market-oriented NPD methodologies, organization for successful NPD; Recipe Development; use of traditional recipe and modification; recent developments in food ingredients/additives flavourings, colorings, emulsifiers, stabilizer and sweeteners; involvement of consumers, chefs and recipe experts; selection of materials/ingredients for specific purposes; modifications for production on large scale, cost effectiveness, nutritional needs or uniqueness; use of novel food ingredients and novel processing technologies.

STANDARDIZATION & LARGE-SCALE PRODUCTION: Process design, equipment needed and Design; establishing process parameters for optimum quality; Sensory Evaluation; Lab requirements; different techniques and tests; statistical analysis; application in product development and comparison of market samples; stages of the integration of market and sensory analysis.

QUALITY, SAFETY & REGULATORY ASPECTS: Product Stability; evaluation of shelf life; changes in sensory attributes and effects of environmental conditions; accelerated shelf life determination; developing packaging systems for maximum stability and cost effectiveness; interaction of package with food; Regulatory Aspects; whether standard product and conformation to standards; Approval for Proprietary Product.

ADVERTISEMENT, MARKETING & CASE STUDIES: Product performance testing; market positioning, Marketing: developing test market strategies; various tools and methodologies to evaluate consumer attitudes, preferences and market acceptance factors; Case Studies of some successes and failures- Factors that influence NPD success, innovation case studies to highlight best practice in terms of the integration of technological and marketing approaches to NPD; food choice models and new product trends.

UNIT X:

FOOD SUPPLY CHAIN MANAGEMENT SUPPLY CHAIN AND QUALITY MANAGEMENT: Introduction, actors in supply chain management, supply chain vs. value chain, factors affecting quality in supply chain management, challenges in supply chain and quality management, pricing and performance measurement in supply chains.

FOOD SUPPLY CHAIN MANAGEMENT SYSTEMS AND INSTITUTIONS: Introduction to FSMS - ISO, GFSI, BRC, IFS, SQF, FSSC; HACCP, Codex, BIS and BIS standards, QCI, EIC, EPC and export regulation, AEPDA, FSSAI and FSSAI Act.

MARKETING AND QUANTIFYING SUPPLY CHAIN: An overview, product differentiation and quality standards, major players in supply chain, marketing channels and legislations, case studies: national and international supply chain management of horticultural produce.

ERP IN SUPPLY CHAIN: Introduction to Enterprise Resource Planning (ERP), inventory management, manufacturing, sales and purchase module, finance module, supply chain management, customer relationship management, HR management module.

LOGISTICS & DISTRIBUTION MANAGEMENT: Physical distribution, distribution channels, channel conflict management, big data analysis, block technology, internet of things, artificial intelligence and sensor based traceability systems in supply chain.

35. MICROBIOLOGY (PG Degree Standard)

CODE: 459

Unit I:

Microbial Morphology Cell ultra-structure - prokaryotes and eukaryotes; Cell wall- structure, chemical composition, synthesis and inhibition; cell membrane, cytoplasmic inclusions, cytoskeleton, cell appendages- capsule, flagella, pili; sporulation - structure of endospore, composition and function of spore constituents, induction and germination; Importance of yeasts and moulds, viruses and phages in dairy foods.

Unit II:

Microbial Growth and Physiology **Bacterial growth:** Growth phases and kinetics; synchronous, continuous, and associative growth; factors affecting bacterial growth - Intrinsic factors and extrinsic factors; Growth measurement; sporulation; Bacterial nutrition; Nutrient media; Nutritional groups of bacteria; Role of growth factors; Transport of nutrients - active and passive transport; Energy metabolism: Electron transport chain, fermentation, respiration and photosynthesis.

Unit III:

Microbial Genetics **Macromolecules:** DNA, RNA and their structure, types, organization, function and properties of macromolecules, DNA replication; Regulation and Gene Expression: Gene Expression and its regulation in Prokaryotes- Transcription, Genetic Code, Translation, Negative and Positive regulation in gene expression, Mutations - Spontaneous and Induced, Type of mutations, Mutagenic agents – physical and chemical; Plasmids and gene transfer systems: Plasmids and their properties, transposable elements, bacterial recombination, transformation, transduction and conjugation.

Unit IV:

Microbiology of Fluid Milk: Common microbes in milk and their significance, Microflora of mastitis milk, Sources of microbial contamination of raw milk during collection, transport and storage; Clean milk production, natural antimicrobial systems in raw milk; Microbial changes in raw milk during long storage, Microbiological grading of raw milk; Microbiological aspects of processing techniques - bacteriostatic, 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; Heat induced damage in bacteria and role of resuscitation in recovery of injured microbial cells.

Unit V:

Microbiology of Dairy Products: Microbiological quality of dairy products - fat rich, frozen, concentrated, dried milks, fermented, infant and indigenous dairy products; Legal standards; Sources of contamination and factors affecting microbial quality of these products during processing, storage and distribution; Shelf life of Dairy Products; Microbiological defects associated with these products and their control; Food poisoning- Food intoxications, Food infections and toxoinfections, pathogens associated with fluid milks, dairy products and their public health significance; Sources of pathogens and their prevention.

Unit VI:

Applications of Biotechnology in Dairy Industry **Recombinant DNA technology;** Restriction enzymes, plasmid vectors, PCR and real time PCR; Genetic improvement of lactic starters to enhance their technological functions for industrial applications - acid, flavour, EPS, probiotic functions; Metabolic engineering of lactic acid bacteria; Production of recombinant dairy/ food enzymes/ proteins -chymosin, lactoferrin, lysozyme, lipases, proteases, immunoglobulins etc.; GMOs, GM foods and their safety from public health point of view; Probiotics, Prebiotics and synbiotics - concepts; Probiotic based functional dairy foods/ health foods and nutraceuticals; Nutrigenomics.

Unit VII:

Dairy Starter Cultures Classification of starters; propagation and preservation of starter cultures (liquid, freeze drying and other methods); factors affecting propagation of starter cultures. Commercial starter preparations: concentrated and super concentrated starters; Production systems for bulk cultures: Lewis, Jones and Tetra-pack systems; growth media: nutritional requirements of lactic acid bacteria, growth media formulations; PIM/PRM, pH control during culturing; preservation of bulk starter cultures- frozen and freeze dried, spray dried cultures; direct vat starter cultures. Growth inhibition of lactic acid bacteria by antibiotics, bacteriocins, bacteriophages, cleaning and sanitizing agents and naturally occurring antimicrobial systems in raw milk; Examination of purity and activity of starter cultures.

Unit VIII:

Environmental Microbiology 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; Waste water treatment: physical; biological unit operations- aerobic and anaerobic cycles; kinetics of biological growth, application of kinetics to treatment systems, aerobic waste treatment, anaerobic waste treatment; tertiary treatment - waste water utilization and disposal. Solid wastes management; environment laws.

Unit IX:

Microbial Food Safety and Quality Assurance 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 X:

Analytical Techniques in Microbiology Enumeration of composite microflora in milk and dairy products - aerobic & anaerobic; Conventional detection methods for indicator organisms – Standard plate count (SPC), coliforms, E. coli, yeast and mould (YMC), spore; enterobacteriaceae; Faecal streptococci; Dye reduction tests; Rapid techniques like D-count, Petrifilm, ATP bioluminescence including VIDAS, SPR, RT-PCR and commercial kits, for monitoring safety indicators; Bio-sensors and micro- techniques for rapid monitoring of contaminants-antibiotics, pesticides, heavy metal, aflatoxin; Microscopy - Staining: simple, differential and special staining; Spectrophotometry, ELISA, protein and enzyme assays, microbiological assay, and microbial receptor assay; Quality requirements of water for dairy plant operations. Characterization of dairy and food industrial waste waters including BOD, COD; Detection of residual antibiotics/pesticides in waste water samples.

36. DAIRY CHEMISTRY (PG Degree Standard)

CODE: 468**UNIT I: PHYSICO-CHEMICAL ASPECTS OF MILK CONSTITUENTS**

Definition of Milk as per FSSAI and average Composition of milk from cow, buffalo and other species. Structural Elements of Milk: Fat Globules, Casein Micelles, Globular Proteins, Lipoprotein Particles and their Properties and Grading of Milk. Basics of chemical reaction kinetics - Order and molecularity - Kinetics of denaturation of whey proteins; Kinetics of enzymatic reactions - Electrolytic dissociation - Redox reactions and photo-oxidation of milk; Adsorption at solid-vapour interphase; Hysteresis. Sorption of water on milk constituents and milk products and its relation to stability of dairy products; foams and emulsions; micelles and gelation

UNIT II: CHEMISTRY OF MILK LIPIDS:

Classification of milk lipids. Composition of milk fat globule membrane. Factors affecting the profile of fatty acids – different properties of fatty acids – unsaponifiable matter and its importance – composition, level and physiological functions; chemical properties of milk lipids –hydrolysis, hydrogenation, halogenation, transesterification; Oxidation of milk fat – auto-oxidation, antioxidants and thermal oxidation of fat.

UNIT III: CHEMISTRY OF MILK PROTEINS:

Nomenclature of milk proteins; genetic polymorphism and biological significance of the chief milk protein- Casein, its methods of isolation, fractionation and heterogeneity; amino acid composition; Casein micelle models; Primary structure of different caseins; Modification of casein: Physical, chemical (glycosylation, phosphorylation) and enzymatic. Minor milk proteins - Whey proteins - alpha-lactalbumin and beta-lactoglobulin, bovine serum albumin: distribution and methods of isolation and their physico-chemical properties; Other Minor milk proteins - Proteose- peptone, immunoglobulins, lactoferrin, and fat globule membrane proteins; Denaturation of milk proteins, various factors affecting denaturation; Casein-whey protein interactions; Enzymes - Indigenous milk enzymes: Properties and their significance

UNIT IV: CHEMISTRY OF LACTOSE:

Molecular structures and isomers; crystalline habits, hydrates, lactose glass, specific rotation, equilibrium of different isomers in solution, solubility, density, sweetness; hydrolysis; Pyrolysis; Oxidation; Reduction; Degradation with strong bases; Derivatives; Dehydration and Fragmentation; Browning reaction; Oligosaccharides in milk

UNIT V: CHEMISTRY OF MINERALS AND VITAMINS:

Minerals in Milk: major and minor minerals; Factors affecting salt composition of milk; Distribution and importance of trace elements in milk. Physical equilibrium amongst milk salts; partitioning of salts; salt balance, salt balance ratio and its importance; protein-mineral interactions. Molecular structure of vitamins, levels in milk and milk products; factors affecting their levels; Biological significance; Ascorbic acid - structure; Relation with redox potential (Eh) of milk and milk products, carotenoids in milk.

UNIT VI: CHEMISTRY OF PROCESSING OF MILK AND DAIRY PRODUCTS:

Heat induced changes in milk; milk stone; Heat stability of concentrated milk; Age gelation; Physico-chemical changes during manufacturing and storage of concentrated milk; dried milk; Mechanism of action of stabilizers and emulsifiers in ice cream; Changes during manufacturing and ripening of cheese;. Lactic acid fermentation in cheese and other fermented dairy products. Chemical defects in cheese. Factors affecting creaming phenomena; mechanism of churning; grading and standards of butter; Physico chemical constants of ghee; Factors responsible for texture (grains) and flavour of ghee. Storage stability of cream, butter and ghee.

UNIT VII: CHEMISTRY OF FUNCTIONAL DAIRY FOODS AND NUTRACEUTICALS:

Bio-functional milk proteins and their therapeutic potential, recent advances in their bio-separation, Phyto-chemicals, Generation of bioactive peptides from casein and whey proteins, their isolation and characterization, colostrums as source of nutraceuticals. Technological and nutritional aspects of milk lipids, conjugated linoleic acids (CLA) in milk, their variation, physiological effects and their importance in dairy foods. Omega-3 fatty acid and their health attributes, strategies to reduce the cholesterol in dairy products. Mineral and vitamin fortification in milk and milk products.

UNIT VIII CLEANING AND SANITIZATION IN DAIRY PLANTS:

Current trends in cleaning and sanitization of dairy equipment; Desirable properties of detergents and sanitizers; commonly used detergents and sanitizers; Determination of temporary and permanent hardness of water. Estimation of residual chlorine in water. Strength of common detergents and sanitizers

used in dairy plant. Methods of cleaning and sanitization: (i) Hand washing (ii) Mechanical washing (iii) Cleaning In Place. Automation, Ultrasonic techniques in cleaning; Bio-films; Bio-detergents, innovations in sanitizers - chemical, radiation; Mechanism of fouling and soil removal; Assessing the effectiveness of cleaning and sanitization of dairy equipment.

UNIT IX: CHEMICAL QUALITY ASSURANCE IN DAIRY INDUSTRY:

Chemical composition and legal standards of milk products - Quality assurance and quality control in dairy industry; quality management systems; Hazard Analysis and Critical Control Points (HACCP); Good Manufacturing Practices (GMP); Good Laboratory Practices (GLP); various standards pertaining to the chemical quality of milk and milk products - ISO 9000; Total Quality Management (TQM); role of international organisations such as ISO; IDF; CAC; AOAC; WTO and national organisations like FSSAI, BIS, AGMARK, EIA and APEDA (Agricultural and Processed Foods Export Development Authority) in dairy industry.

UNIT X: ANALYTICAL PROCEDURES AND TECHNIQUES IN DAIRY CHEMISTRY:

Preparation of standard solutions and reagents for various chemical analyses of milk and dairy products. Checking the accuracy of calibration of hydrometers/ lactometers, butyrometers, milk pipette and thermometer. Sampling techniques of chemical examination of milk and dairy products. Determination of pH and titratable acidity of milk. Determination of fat in milk and dairy products by different methods. Determination of total solids and solids not fat in milk. Determination of total milk proteins by Kjeldahl method. Determination of casein, whey proteins and NPN in milk. Estimation of alkaline phosphatase and lipase in milk. Determination of lactose in milk. Determination of ash in milk. Determination of phosphorus and calcium in milk. Determination of chloride in milk. Assessment of homogenisation efficiency in milk. Detection of adulterants and preservatives in milk and milk products; Detection of agrochemicals, microbial toxins, antibiotic residues, heavy metals, radionuclides in milk and dairy products. Sampling and chemical examination of pasteurized, sterilized and UHT processed milk. Chemical examination of concentrated and dried milks including Dairy whitener for Moisture, Total Solids, acidity, fat, lactose, bulk density and solubility index. Grading and quality of raw milk for condensed and evaporated milk. Sampling, determination of melting/slip point, moisture of ghee by gravimetric method, B.R. Index and Baudouin Test. Acidity, Helphen Test for the presence of cotton-seed oil. R.M. value and Polenske value. Saponification value. Iodine value. Peroxide value. Detection of animal body fats and vegetable oils. Examination of the quality of sodium chloride for butter making. Automated milk analysers. Flavour, Colour and texture profiling of dairy products. Electrophoresis: principle and types, isoelectric focussing. Column Chromatography, TLC, GLC, HPLC, GC-MS, LC-MS, ICPMS, gel-permeation, ion-exchange, affinity chromatography Spectrophotometry: UV, visible, IR and flame photometry; potentiometry: principle, various electrodes; buffers. Immunobased analytical techniques such as ELISA & Lateral flow assay Separation of bio-molecules using membranes; ultracentrifugation. NMR (Nuclear Magnetic Resonance), FTIR (Fourier Transform Infrared)-Principle, application for quality analysis of milk and dairy products. Measurement of BOD and COD in dairy effluent.

37. CLINICAL PHARMACOLOGY (PG Degree Standard)

CODE: 352

UNIT I: GENERAL PHARMACOLOGY

Sources of drugs, Routes of drug administration, Dosage formulations, Pharmacokinetics, Pharmacodynamics - Good Clinical Practice & Good Manufacturing 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 and diseases, Spurious drugs, Counterfeit drugs - Pharmacoepidemiology and Pharmacovigilance– Pharmacogenetics

- Adverse drug reactions and monitoring - Clinical importance of drug interactions (both pharmacokinetic and pharmacodynamic interactions with special reference to antibiotics, anti-bacterials, NSAIDs and cardiovascular drugs) - Therapeutic drug monitoring.

UNIT II: DRUG THERAPY IN SPECIAL SITUATIONS

Geriatrics – Pediatrics - Pregnancy and Lactation.

UNIT III: CHEMOTHERAPY

Chemotherapy of bacterial (including Tuberculosis & Leprosy) -viral –fungal - protozoal - helminthic infections - Neoplastic diseases.

UNIT IV: DRUGS ACTING ON NERVOUS SYSTEM - CENTRAL NERVOUS SYSTEM

General anaesthetics – Narcotics – Antiepileptics - Sedatives and Hypnotics - Psychopharmacological drugs - CNS Stimulants - Neurodegenerative disorders – Hallucinogens - Deaddiction for alcohol and other drugs of abuse.

UNIT V: PERIPHERAL NERVOUS SYSTEM & AUTONOMIC NERVOUS SYSTEM

Local Anaesthetics -Skeletal Muscle Relaxants – Atropine & Substitutes – Adrenaline & Derivatives – Drugs in Glaucoma.

UNIT VI: CARDIOVASCULAR DRUGS

Hypertension - Angina & Myocardial Infarction - Congestive Heart failure - Arrhythmias.

UNIT VII: ENDOCRINOLOGY

Anterior pituitary Hormones - Thyroid Hormones – Corticosteroids-Insulin & Oral Hypo glycaemic drugs - Male & Female sex Hormones - Oral contraceptives - Uterine stimulants & relaxants.

UNIT VIII: DRUGS ACTING ON HEMATOPOIETIC SYSTEM, RENAL AND GIT

Haematinics- Coagulants & Anticoagulants – Fibrinolytics & Antifibrinolytics - Antiplatelets, Hypolipidemic Drugs – Diuretics - Drugs Acting on GIT.

UNIT IX: IMMUNOPHARMACOLOGY& AUTOIMMUNE DISEASES

Cell and biochemical mediators involved in allergy, immunomodulation and inflammation, hypersensitivity reactions - therapeutic agents for allergy, asthma and COPD - NSAIDs & DMARDs & gout – Antihistamines - Serotonin agonists & Antagonists.

UNIT X: MISCELLANEOUS

Vaccines - Dermatological preparations - Chelating Agents – Nutraceuticals - Supplementary & formula feeds – Toxicology.

38. MICROBIOLOGY (MEDICINE) (PG Degree Standard)

CODE: 351

UNIT I: GENERAL MICROBIOLOGY

1. History & Milestone in Microbiology
2. Microscopy
3. Sterilization and disinfection
4. Bio Safety in Microbiology Laboratory
5. Bacterial morphology
6. Staining of Bacteria

7. Nutrition and growth of Bacteria
8. Culture Media & Cultivation of Bacteria
9. Identification of Bacteria & Bacterial Classification
10. Normal Microbial flora
11. Bacterial Genetics

UNIT II: IMMUNOLOGY

1. Immunity
2. Structures and functions of Immune system
3. Cells of Immune System
4. Immune Response/Immunity
5. Antigen
6. Antibody
7. The complement System
8. Antigen – Antibody reactions
9. Hypersensitivity
10. Auto Immunity
11. Histo-Compatibility complex
12. Transplantation Immunity
13. Tumour Immunity
14. Immuno Deficiency diseases
15. Immuno Hematology
16. Immuno Prophylaxis against infectious Diseases

UNIT III: SYSTEMATIC BACTERIOLOGY

1. Staphylococcus
2. Streptococcus
3. Neisseria
4. Coryne bacteria .
5. Bacillus
6. Mycobacteria
7. Actinomyecetes & Nocardia
8. Coliform bacteria-Escherichia coli & kelsiella 9 Proteus
9. Salmonella
10. Shigella
11. Yersinia
12. Pasteurella & Francisella
13. Haemophilus
14. Bordetella
15. Brucella
16. V. Cholerae
17. Pseudomonas
18. Spirochetes
19. Rickettsiae
20. Chlamydia
21. Mycoplasma
22. Miscellaneous Bacteria

UNIT IV: PARASITOLOGY

1. Classification
2. General principles of Diagnosing parasites & treatment of parasitic infection .
3. Protozoology Pathogenic and Non-pathogenic amoebae and free living amoebae Intestinal ,Blood & Tissue flagellates Plasmodium, Toxoplasma, Isospora
4. Balantidium coli
5. Helminthology, Cestodes, Trematodes, Nematodes

UNIT V: GENERAL VIROLOGY

1. Classification of viruses
2. Replication of Viruses
3. Cultivation of Viruses
4. Identification of Viruses & Lab diagnosis
5. Pathogenesis & Host response to Viral infection
6. Bacteriophage
7. Antiviral Agents
8. Viral Vaccines

UNIT VI: VIRUSES

1. Pox
2. Adeno
3. Herpes
4. Papova
5. Parvo
6. Picorna
7. Orthomyxo
8. Paramyxo
9. Rota virus
10. Rhabdovirus
11. Hepatitis
12. Arbo
13. Retro
14. Slow-viruses
15. Oncogenic virus
16. Miscellaneous virus

UNIT VII: Mycology

1. Classification of fungi
2. Fungal Mycotoxins
3. Pathogenesis & Lab diagnosis of Mycotic infections
4. Superficial Mycosis
5. Cutaneous Mycosis
6. Subcutaneous Mycosis
7. Systematic Mycosis
8. Opportunistic Mycosis and common lab contaminants
9. Antifungal Agents

UNIT VIII: Clinical Microbiology

1. C.N.S infection
2. Respiratory Infections

3. Urinary Tract Infection
4. Gastro intestinal Infection
5. Genital Tract Infection
6. Congenital Infection
7. Infections of Eye, Ear & Skin
8. Infections of Cardiovascular System
9. P.U.O
10. Zoonotic Infections

UNIT IX: Applied Microbiology

1. Collection ,Transport and Disposal of Specimens
2. Environmental Microbiology (Food, Water, Milk and Air)
3. Hospital Infections Prevention & Control
4. Microbial Control- anti microbial susceptibility testing
5. Bio medical waste management
6. Basic molecular biology related to infections
7. Emerging and reemerging infections – Bio Terrorism

UNIT X: Recent Advances in Microbiology

1. Advanced Molecular Techniques in Relation to Diagnosis of Infectious diseases
2. Scope of Medical Microbiology
3. Automation in Microbiology
4. Anti microbial resistance and antibiotic policy
5. Newer Vaccines
6. Quality Control, Audit and Accreditation of Standard Microbiology Laboratory

39. EVALUATION AND APPLIED RESEARCH

CODE: 213

Unit I:

Indian Economy – Growth and development: Agriculture: Area, Yield, Production, marketing and sales. Rural Development – Industry: Input and output – Service Sector: Types of service sector, skilled labour, semi skilled labour and unskilled labour – Changing Sectoral contributions – Industrial Policy Changes – FDI – Infrastructure: Public Health – Education – drinking water – sanitation – Public transport –Banking and financial services–housing facilities–Nutrition – Investment – Public Private Participation – Inclusive growth. Human Development: Concepts, Trends and Issues – Employment, unemployment, under employment and disguised unemployment – concepts, measurement and Trends – Employment in Organized and unorganized sector – Strategies for Employment Generation. Poverty: Concepts, measurement and Trends, Fiscal Policy – FRBM Act – Goods and Service Tax (VAT)– Fiscal Federalism – Parallel economy in India – Inflation: Definition, trends, estimates, consequences and remedies – RBI – Monetary and Fiscal policy – Banking Sector Reforms – India's foreign trade, composition, direction and recent changes in trade policy – Balance of payments – India and WTO requirements – Global Financial Crisis and its Impact on India. Index number: Consumer price index – Whole Sale price Index. Time series analyses-Moving average Method.

Unit II:

Primary data collection-Field Investigation- Census method-Sampling Method – Direct personal observation-Interview method- Indirect oral interview-Information through agencies-Mailed Questionnaires and scheduled sent through enumerator.Secondary data collection- Books-Journals-Government (Ministry) Records and reports from government agencies- Bibliography-Autography- Web site-News Paper- Periodicals, etc Evaluation and preparation of the report and components of evaluation Report:

Executive summary-background and purpose-statement of the problem-objectives and Hypotheses – evaluation methods (Statistical methods used in the study) –result and discussion of the result –conclusion and recommendation- reference or bibliography- appendices.

Unit III:

Econometrics - definition, methodology, Data – meaning and types of data such as cross-section, time-series and panel data, primary & secondary data- advantages & disadvantages, Variables – meaning and types such as quantitative and qualitative variables, measurement scales of variables such as ratio, interval, ordinal and nominal simple examples. Correlation – simple and multiple correlation, properties of correlation coefficients, Karl Pearson's and Spearman's rank correlation coefficients, Simple numerical problems - Simple & multiple linear regression model – introduction, assumptions, least squares principle, least squares estimators, properties of regression coefficients(Gauss-Markov theorem), interpretation of regression output - R^2 & adjusted R^2 , regression coefficients with t-values and level of significance, Simple numerical problems - advantages of regression analysis over correlation analysis, Functional forms of regression models – log-linear, log- lin and lin-log models and computation of elasticity, computation of simple and compound growth rates - simple numerical examples.

Unit IV:

Econometric Problems: heteroscedasticity, multicollinearity and autocorrelation – definition and consequences. Dummy variables: definition, generation of dummy variables, problem of dummy variable trap, cautions in using dummy variables, inclusion and interpretation of dummy variables in the regression. Qualitative response regression models – linear probability, logit and probit models – an introduction. Basics of time-series: additive and multiplicative models, determination of trend by free drawing, moving average methods, and seasonal indices, definition of stationarity, tests for stationarity and transformation of non-stationary series into stationary series.

Unit V:

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) 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.

Unit VI:

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, 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 – Critical Region – Power function. Testing of significance using chi-square, t and F tests. (simple problems) 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.

UNIT VII:

Theory of Consumer Behavior - Utility and its measurement - Indifference curve analysis and Consumer's surplus. Demand and supply functions - Elasticity of demand and supply - Factors affecting demand and supply. National Income - Concepts and measurement. Classical and modern theories of Employment. Consumption function - Investment and savings. Concept of Multiplier and Accelerator. Inflation - Nature, Effects and controlling mechanisms. Monetary policy and Fiscal policies and Role of RBI. Types of Market Structure - perfect competition, monopoly, monopolistic. competition, oligopoly and price determination. Agricultural marketing - Characteristics of Agricultural products and constraints in marketing agricultural produce. Marketable and Marketed surplus estimation. Estimation of price spread and Marketing Efficiency. Market integration, Marketing Intelligence and Marketing Acts. Institutions in Agricultural Marketing - Regulated Markets, Cooperatives, Commodity Boards, Contract Farming, Commodity Exchanges, Farmers' Markets and Farmers Producers Organizations. Commission on Agricultural Costs and Prices - Agricultural Price fixation and price support programs and policies. Price forecasting. Supply chain Management and logistics. Development planning in India - Agriculture in five year plans. Land tenure and reforms. Unemployment, Poverty and inequality. Food and nutritional security. Population policies. Income distribution - Social Choice Theory - Public goods - Welfare economics. Rural Indebtedness. Financial Institutions and Credit Flow to Rural/ Priority Sector. Agricultural Lending - Direct and Indirect Financing - Financing through Co- operatives, Commercial Banks and RRBs - Role of Lead Bank and NABARD - District Credit Plan. Credit linked Rural Development Programs - RIDF. Micro-Financing - Role of MFI's, NGO's, and SHG's. Credit Inclusion–Credit Widening - Credit Deepening. Risk in agriculture and different Crop Insurance Programs - Agricultural project preparation - project cycle - Costs and benefit analysis – Discounted and Undiscounted Measures – Sensitivity analysis. Technical feasibility of economic viability of projects. Use of Network techniques – Project monitoring and evaluation. Forms of production functions – Returns to scale vs Economies of scale. Cost of cultivation vs Cost of Production – Cost concepts – Fixed Cost, Variable cost, Average Cost and Marginal cost. Efficiency Measures – Technical and Economic Efficiency. Financial statements and ratio analysis. Partial and complete budgeting and their applications.

UNIT VIII:

Concepts, Classification and Problems of Natural Resource Economics. Economy and Environment interaction. Resource scarcity – Limits to Growth – Measuring and mitigating natural resource scarcity–scarcity indices. Malthusian and Ricardian Scarcity. Theory of optimal extraction of exhaustible and renewable resources. Property rights – Issues in natural resource management – private property, common property and open access resources – Collective action in common property resource management. Land use planning – optimal management of land, water, forests and fisheries. Resource mapping – GIS and remote sensing applications. Environmental problems and quality of environment – Economics of the environment –Theory of externality. Sources and types of pollution – air, water, solid waste, land degradation – Environmental and economic impacts. Economics of pollution control – efficient reduction in environmental pollution. Environmental regulation – Economics instruments and indirect instruments (command and control policies). Environmental legislations in India. Concept of sustainable development – Indicators of sustainability. Environmental Accounting – resource accounting methods. Climate change and its impacts – mitigation efforts and international treaties. International Trade and Comparative Advantage. Terms of Trade and Instruments of Trade Policy – Tariffs and Non tariffs. Balance of Trade vs Balance of payments. Exchange Rates. International Organizations – IMF, IBRD, IDA, IFC. WTO. Fundamental vs. Applied Research – Qualitative vs Quantitative Research. Research Prioritization – Identification of Research Problems and Prioritization. Research Process. Trade-off between scope and cost of the study. Research Design and Techniques. Hypothesis – Meaning – Characteristics – Types of Hypothesis and Testing. Setting of Objectives and Hypothesis. Sampling Theory and Sampling Design. Sampling Error. Sampling methods – Probability and Non-Probability methods. Interviewing Techniques – Questionnaire vs Interview schedules and Field Problems – Methods of Conducting Survey. Types of data

– Primary and Secondary data. Sources of Secondary Data and Data collection techniques. Types of questions in interview schedule – Structured, Unstructured, Open Ended and Closed-Ended Questions. Data coding and data entry. Data Tabulation and Validation of Data. Data Processing. Application of Analytical tools to data – Simple and Multiple regression and problems in estimation – Multicollinearity, Heteroscedasticity and Autocorrelation. Optimization Models – Linear Programming: Concepts and theories. Problem formulation – Minimization and Maximization problem (Primal and Dual solutions). Sensitivity analysis. LP in farm planning and regional planning. Risk Programming and dynamic programming techniques.

Unit IX:

Nature and Scope of Sociology, Sociology as a Science. Individual and Society. Social Process: Competition, conflict, Co- operation, Accommodation, Assimilation, Social control. Social Institutions: Family and Marriage. Theoretical Perspectives:- Structural Functional Perspective: August Comte, Herbert Spencer, Max Weber, Emile Durkheim, R.K. Merton. Conflict Perspective: Karl Marx, Ralf Dahrendorf and L. A. Coser. Caste System in India: Origin of the caste system; cultural and structural views about caste; mobility in caste; change and persistence of caste in modern India; views of Gandhi and Ambedkar about caste system. Class Structure in India: Agrarian and industrial class structure; emergence of middle class. Rural Social Structure: Village Social Structure and Importance of Village Studies. Peasant society and agrarian systems; land tenure systems, social consequences of land reforms and green revolution. Agrarian unrest and movements in India. Rural social problems in India: poverty, unemployment, indebtedness, farmer's suicide and bonded labour. Strategies of rural development programmes. Tribal Societies in India: Type and distinctive features of tribal communities in India and their geographical spread. Problems of tribal communities: land alienation, poverty, indebtedness, health and nutrition, education, Integration and issues of tribal identity. Tribal development policies after independence.

Unit X:

Socio- religious reform movements: Bhakthi Movements, Arya Samaj, and Ram Krishna Mission. Backward Class Movements: Satya Sadhak Samaj, Sri Narayanguru Dharma Paripalana Movement (SNDP), Self-respect movement, Dalit Movements, Political Mobilization of Backward Classes. Women in Indian society: Socio-cultural interpretation of women in India. Demographic profile of women. Problems of Women in India: dowry, domestic violence, discrimination, female infanticide, honor killing, sexual harassment. Women empowerment programmes and SHGs. Social Research: Meaning of Social Research, Scope and Importance of Social Research. Types of Research, Research Process: Identification and formulation of research problem. Methods of Research: Descriptive and Explorative methods. Sampling Methods, Methods of Data Collection. Tools of Data Analysis: Univariate and Bivariate Statistics, Chi-square Test. Application of ICT in Social Research. Evaluation Research: Meaning and aims of evaluation research. Types of evaluation and their purpose. Levels of measurement: population-based vs. program-based. Sources of data. Study designs. Impact Assessment Research: Programmes and policy evaluation research. Environmental impact assessment research. Research Report Writing: Organization of a research report: Title, Abstract, Introduction, Experimental Details or Theoretical Analysis, Results, Discussion, Conclusions and Summary, References. Quality of good research report. Significance of research report.

Unit XI:

Public Administration Theory and Principles - Public Administration: Meaning and scope and significance – Public vs Private Administration – Approaches to the study of Public Administration-Comparative Public Administration – Development Administration - New Public Administration – New Public Management - Principles of Organization and Administration – Classical theories – Human Relation theories – Modern theories of administration – Bureaucratic culture-Administrative Responsibility and Ethics.

Unit XII:

Public Administration in Practice - Public Financial Administration: Budgetary process and accountability, 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: Personnel and Administrative Reforms, Urban Governance: Urban Local bodies in Tamil Nadu, Jawaharlal Nehru National Urban Renewal Mission (JNNURM) in Tamil Nadu – Tamil Nadu Urban Development Project – Human Rights governance: the Tamil Nadu State Human Rights Commission- Social Science Research: Meaning, nature and scope of social science research- Qualities of good researcher - Types of social science research: Historical-Descriptive-Empirical-Experimental-Qualitative- Quantitative - Hypothesis-Variables-Sampling: Probability and Non-Probability sampling – Methods of Data Collection: Primary and Secondary data- Observation-Schedule- Survey-Interview-Questionnaire-Measurement- Data Analysis- Tabulation-Inferences- Research Design and Report.

Unit XIII:

Social work research - Scientific Method: Objectivity, Scientific attitude, Ethics in research; Types of Research: Applied and Pure, Quantitative and Qualitative, Mixed methods, Participatory, Action research, Evaluative, Field based research. Research as a method in Social Work. Research process: Classification of Variables, Concepts, Constructs, identifying and formulating research problem, research questions, defining objectives, hypotheses. Research Designs: Exploratory, Descriptive, Diagnostic, Experimental, Evaluative and Participatory. Sampling Methods : Probability and Non- probability sampling techniques. Data Collection: Types of data, data collection methods, Questionnaire, Interview Schedule, Interview Guide, Observation (Participatory and non participatory) Qualitative Research techniques: FGDs, In-depth interview, Transcription, Themes, Illustrative quotes. Appreciative inquiry technique. Photo voice technique. Social Audits. Triangulation and Iteration.

Unit XIV:

Project evaluation - Project identification and formulation – Classification of projects, Project objectives, Project life cycle and phases, Project Planning and Organization. Project feasibility analysis (Financial, Technical) Market Survey, Demand analysis, Forecasting and Projection. Terms of reference: Area of study, documents needed, process, time frame, Team members. Evaluation design; Types of Evaluation; Project design: Time management, sequencing and scheduling, Network Analysis, CPM and PERT, Logical Framework Approach (LFA), Problem Analysis and Problem Tree. Log Frame Matrix, Social Cost – Benefit analysis, Environmental Impact Assessment, Legal aspects and clearance. Factors such as efficiency, effectiveness and sustainability of the project. Project appraisal and Implementation: Project Appraisal methods: (Financial, Technical) Project Financing, Project Resource mobilization, Negotiation, Decision making, Project control and Monitoring techniques, Project evaluation: Tools of Evaluation: Ladder of Life (UN tool). Community impact assessment, Holistic World View Analysis, Vulnerability Assessment, Impoverishment assessment, FGDs and Reporting on Evaluation.

UNIT XV:

Basics and Major areas of Management - Concept and Foundations of Management – Managerial Functions – Planning and decision making, Organizing, co-ordination and control – Role of Manager – Managerial skills – Management of innovation –Personality Theories and Determinants – Meaning and Process of perception – Motivation Concepts, Theories and Applications. Leadership – Theories and Styles – Quality of Work Life (QWL) – Quality Circles (QC) –Management of Conflicts in Organizations – Demand analysis and forecasting – cost functions – Break-Even-Analysis - Theory of firm-profit maximization and sales maximization – Pricing decisions under different market structures. National

income- GNP, GDP, Gross Domestic savings – Monetary and Fiscal policies – Business cycle. Fundamentals of operations management – Aggregate production planning, capacity planning – plant design – process planning – plant size and scale of operations – Management of facilities –Production control – Supply chain management - Quality management – statistical process control-role and importance of material management – Modern production concepts – JIT, Kaizen, Japanese 5's framework. Nature and scope of financial management – finance function- valuation concepts and Valuation of securities- financing decisions- sources of finance- cost of capital and capital structure – Investment decisions – Capital budgeting – Working capital management – Dividend decisions. Marketing Management – evolution and scope – Marketing strategy formulation and components of marketing plan – Segmenting and targeting the market – Positioning and differentiating of the market – Analyzing competition – Analyzing consumer markets – Industrial buyer behavior – Marketing research – Product strategy – Pricing strategies – Designing and managing Marketing channels – Building customer satisfaction –Ethics in marketing – Consumer protection - Concepts and policies of HRM – HRM functions – Future challenges of HRM-Human resource planning – Job analysis – Job evaluation – Recruitment and selection – Training and development – Promotion and transfer – compensation – performance appraisal and 360 degree feedback – HR audit – Handling of sexual harassment in the work place-current trends and issues in HRM. Nature and scope of strategic management – Strategic intent, vision, objectives and policies – Process of strategic planning and implementation – Environmental analysis and internal analysis – SWOT analysis – Tools and techniques for strategic analysis – Impact matrix – The experience curve – BCG matrix – Balanced Score Card - Du Pont's control model.

UNIT XVI:

Research methodology and management information system - Research – meaning, scope and objectives-types of research – research design-Data collection and Tabulation – Questionnaire design – Scaling technique – sources of secondary data– Sampling – Probability – Correlation and Regression Analysis – Tests of Significance – Normal distribution, Chi-square, F and t tests, ANOVA, time series and forecasting decision theory, index numbers – Multi-Variant analysis, Factor analysis – Discriminate analysis – report writing – Types of Report – structure of the Report – Guidelines for Report writing . Conceptual foundations of information systems – Types of information systems - Element of information system – Data Vs. Information – information requirement at various levels – data processing – data base – Data Entry -Development and Management – Systems analysis and design – Trends in information technology – Flexibility in information systems – User involvement – Evaluation of information systems – Security and ethical challenges.

Unit XVII:

Algebra and Differential Equations - Groups: Groups – Sub groups – Normal subgroups and quotient subgroups – Homomorphisms – Automorphisms – Cayley's Theorem – Rings: Rings - Special class sub rings - Homomorphisms – Ideals and Quotient Rings – Vector Spaces: Basic Concepts – Linear Independent and Bases – Inner Product Spaces – ODE: ODE with constant coefficients – ODE with variable coefficients – Higher order ODEs – PDE: First order PDE - Second order PDE – Elliptic, parabolic, and hyperbolic PDEs.

Unit XVIII:

Analysis - 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 – Convergence, completeness and Baire's Theorem - Continuous mappings - Space of continuous functions - Euclidean and Unitary spaces - Topological Spaces: Basis for a Topology – The Product Topology – The Metric Topology – Connected Spaces – Connected Subspaces of the Real Line – Components and Local Connectedness. Decision Making: Basic Statistics: Moments – Mean – Variance – Standard deviations – Linear regression – Rank correlations – Attributes – Index Numbers. Linear Programming Problem: Graphical Methods – Travelling Salesman Problem – Assignment Problem – Simplex Methods.

Unit XIX:

Anthropology, meaning scope and relationship with other disciplines particularly social sciences, humanities etc. Main branches, their scope, The nature of culture, The nature of society: concept of society, society and culture, social institutions, social stratification Marriage: Definition and universality, Family, Kinship, Economic organization: meaning, scope, and relevance of economic anthropology, Religion Research methods in Anthropology - Field work tradition in Anthropology - Distinction between techniques, methods, methodology - Tools of data collection, observation, interview, schedules, case study, genealogy etc.

Unit XX:

Evolution of the Indian culture and civilization: Palaeolithic, Neolithic, Harrappan cultures; Tribal cultures of India, Brief ethnographic details of Tribes of Tamil Nadu. Caste system in India: Structure and characteristics, theories of origin of caste, Dominant caste. Indian village: Indian village as a social system, peasant cultures. Cultural change in Indian Society: Sanskritization, Westernization, Modernization, Post – Modernism, Globalization; Problems of the tribal communities a) poverty b) low literacy c) health Development of forest policy and Tribals Constitutional safe guards for ST/SC, Role of Anthropology in Tribal and Rural development. Demographic profile of India – Ethnic and Linguistic elements in the Indian population and their distribution. Gender issues in Tamil Nadu.

40. PHYSICS (Degree Standard)

CODE:241

UNIT I: MECHANICS AND RELATIVITY

Gravitation- Kepler's law- Gravitational constant and their determination variation of 'g' - Centre of gravity - Centre of gravity of a solid hemisphere - Hollow hemisphere - Tetrahedron and solid cone - Friction – Lubricants - Laws of friction - Cone of friction - angle of friction - Equilibrium of a body in a inclined plane - Impulse – Impact- Laws of Impact - Direct and oblique impact - Impact between two spheres - Loss of Kinetic energy – Moment of Inertia - Angular momentum and Kinetic energy of a revolving body - Moment of inertia of a sphere, shell and cylinder - Compound pendulum - Newton's laws and their limitations - postulates of special theory of relativity - Lorentz transformation equations and its applications - variation of Mass with Velocity - Mass - energy equivalence – Physical significance

UNIT II: PROPERTIES OF MATTER

Elastic moduli - Relations - Couple per unit twist - Torsional oscillations - Bending of beams - Uniform and Non uniform bending - Elastic constants and their determinations - Viscosity of liquids - Highly viscous liquids – Stoke's and Searle's method- Surface Tension - Capillary rise - Method of drops - Surface tension of mercury - Quincke's Method - Laws of osmotic pressure and experimental determination of osmotic pressure- Fick's laws of diffusion - Determination of diffusivity – Applications

UNIT III: HEAT AND THERMODYNAMICS

Specific heat capacity – Determination of specific heat capacity by Newton's law of cooling- Debye's theory- Mayer's relation - Vanderwaal's equation - Critical constants and Vanderwaal's constant - J K effect - Theory and experiment – Liquefaction of gasses – Hydrogen - Helium - Thermal conductivity - Forbe's

method - Stefan's law - Experimental determination of Stefan's constant- Solar constant - Temperature of the sun Zeroth, first law and second laws of thermodynamics - Isothermal and adiabatic change - Reversible and irreversible process - Carnot's theorem- Carnot engine - Carnot cycle - Entropy - Maxwell's thermo dynamical relations and its applications - Third law of thermodynamics

UNIT IV: SOUND

Simple harmonic motion - Composition of two SHMs along a straight line and at right angles - Lissajou's figures - Laws of transverse vibrations - verification by sonometer and Melde's string - Forced vibrations and resonance - Beats - Doppler effect - Velocity of sound in solids and gases – Theory and experiment - Ultrasonics - production, properties and applications - Acoustics of buildings

UNIT V: OPTICS AND SPECTROSCOPY

Spherical aberration - Chromatic aberration and their rectifications – Coma- Eyepiece - Ramsden's and Huygen's eyepieces - Interference - Colours of thin films - Newton's rings - Theory and experiment - diffraction – Fresnel's and Fraunhofer types - Zone plate -Diffraction grating – Prism- Grating spectra - dispersive and resolving power of a grating - Double refraction - Huygen's explanation – Nicol's prism - Quarter and half wave plates - Production and detection of plane, circular and elliptically polarized light - optical activity - Determination of specific rotatory power – Polarimeter UV and IR Spectroscopy - Principle and application - Raman effect - Explanation of Raman effect on the basis of quantum theory - Applications of Raman effect - Optical fiber - Fiber optic sensors - Fiber optic communication systems and their advantages - Lasers - Population inversion - Ruby and Helium Neon Lasers and applications.

UNIT VI: WAVE MECHANICS

De Broglie concept of wave theory- Wave velocity and group velocity - De Broglie relations – Heisenberg's uncertainty principle – Basic postulates of wave mechanics- Schrodinger's Wave equation - Eigen function and Eigen values- Particle in a box – Linear harmonic oscillator (one dimension only)

UNIT VII: ELECTRICITY AND MAGNETISM

Coulomb's law - Permittivity of free space - Relative permittivity - Electric field - Intensity of field due to a point charge - Gauss theorem and its application - Electric potential - Relation between potential and intensity - Electric dipole moment - potential and intensity due to a dipole- Capacitance - Capacity of a spherical, parallel and cylindrical capacitors - Energy of a charge capacitor - Dielectric constant - Ohm's law - Resistivity and conductivity - Internal resistance of a cell - EMF and Potential difference - Thermo Electricity - Peltier and Thomson Co Efficients - Laws of Electrolysis - Conductivity of an electrolyte Arrhenius theory of electrolytic conduction - Calculation of emf of Daniell cell as reversible cell Magnetic field around a current carrying conductor - Biot and Savart's law - Ampere's law of magnetic force due to a current - Force between two current carrying parallel conductors- Force on an electron moving in a magnetic field - Faraday's laws of electromagnetic induction - Self and mutual inductance - Induction coils and its uses - Eddy currents - Transformers - Energy losses - Skin effect - Advantages of AC distribution over DC - Dynamos and motors - Magnetic poles - Magnetic moments - Susceptibility - Relation between susceptibility and permeability - Hysteresis - Dia, para, ferro magnetism - Electromagnetic waves in free space.

UNIT VIII: ELECTRICAL CIRCUITS AND ELECTRONICS

Kirchoff's laws for a loop and a junction - Measurements of circuit parameters (R,L and C) - AC circuits - Complex impedance and phase diagram – LCR Circuits - Series and parallel resonant circuits - Sharpness of resonance q factor. Semiconductors - Energy band theory of solid - Insulators - Conductors and Semiconductors - Intrinsic and extrinsic semiconductors - Electrons and holes as charge carriers - P-type and N-type semiconductors - Junction diodes - Characteristics of a diode - Diode applications - Junction transistors - characteristic of transistors - Rectifier, Amplifier and oscillator circuits - AM and FM transmission with block diagrams - Basic principles of super heterodyne receiver with block diagram -

Photo conductive cell - Photo diode - Solar cell - LED and LCD - construction and working T.V Camera - Vertical and Horizontal scanning - T.V Transmission and reception with block diagrams - T.V Antenna (Yogi type) - Colour TV - Three colour theory - Radar - Uses of radar. Logic circuits - AND, OR, NOT NAND, NOR and EX-OR gates - Truth tables - Multivibrators - Astable multivibrators - Flip flop circuits (RS and JK flip flops)

UNIT IX: MODERN PHYSICS

Canal rays - e/m of positive ions - Thomson's parabola method - Aston's mass spectrograph - Plank's quantum theory of black body radiation - Photoelectric effect - photo electric multipliers - Einstein's equation for photo electric effect - Millikan's experiment - Determination of Plank's constant. Bohr's theory of hydrogen atom - Spectra of Hydrogen and Hydrogen like atoms - Rydberg's constant - Spatial quantization - Sommerfeld atom model – Vector atom model- Seven quantum numbers - Pauli's exclusion principle - Examples of electronic configuration – Magnetic moment due to orbital motion and electron spin - Bohr magnetron - Experimental verification - Fine structure of sodium D Line - Zeeman effect - Anomalous Zeeman effect - Theoretical explanation

UNIT X: NUCLEAR AND SOLID STATE PHYSICS

Properties of nucleus - size, charge, mass and spin - Nuclear magnetic dipole moment - Binding energy - Packing fractions - Nuclear forces - Nuclear models - Shell model and liquid drop model - Nuclear reactions – Radio activity and induced radio activity- Artificial transmutation Techniques - Application of Radio isotopes - Discovery, Production and detection of neutron - Accelerators - Betatron - Proton Synchrotron - Particle Detectors - Ionization chamber - GM counter - Elementary particle – Baryons and Leptons – Cosmic rays Structure of crystals - Periodicity and plane in crystal - Symmetry elements and symmetry groups - Classification of crystals - Unit cell and crystal types Bonding - ionic, covalent, metallic and Vander wall's- X-rays - Bragg's law and absorption of X rays - Mosley's law - Compton effect

41. TRANSLATION (Descriptive Type)

CODE: 462

Translation of the following from English to Tamil:

- (a) State Acts, Bills, Ordinances, Rules and Notifications made thereunder.
- (b) Central Acts, Ordinances, Rules and Notifications made thereunder.
- (c) Legal Terms / Legal Maxims.

42. BUSINESS ADMINISTRATION (PG Degree Standard)

CODE: 385

Unit I: Management Concepts

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

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

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

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

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

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

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

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

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

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 & Uncertainty -Risk Management- Return on Investment.

43. BASICS OF ENGINEERING (Degree Standard)

CODE: 422

Unit I: Mathematics

Matrices: Eigenvalues - Eigenvectors 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

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 – CO₂ 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

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

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

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 - Ladder 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

Ohm's law – Kirchhoff'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

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

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, BenchMarking, 6 sigma, Quality Function Deployment (QFD), POKAYOKE, Total Productive Maintenance (TPM), Business Process Reengineering (BPR), Quality Certifications.

Unit IX: Environmental Science and Engineering

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 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.

44. ANTHROPOLOGY

(PG Degree Standard)

CODE: 312

UNIT I: FOUNDATIONS OF ANTHROPOLOGY

Meaning and scope of Anthropology - Major branches of Anthropology - and Contemporary divisions. The relevance of holistic perspective and its interrelations with other disciplines. Indian Anthropologists and their contribution to the society and cultures of India.

UNIT II: PHYSICAL ANTHROPOLOGY

Branches of physical anthropology, Organic Evolution, Human Evolution, Human Variations, Race & Ethnicity, Ethnology and Biology, Biological and Physiological Anthropology, Anthropometry, Forensic Anthropology, DNA techniques and the prevention of genetic diseases.

UNIT III: ARCHEOLOGICAL ANTHROPOLOGY

Broad outlines of pre-historic cultures (India and Europe), Palaeolithic - Mesolithic - Neolithic - Chalcolithic - Iron age - Geological time scale - A brief account of stone tool Typology and Technology and methods of problems of dating, Prehistoric and excavated sites in Tamil Nadu and recent findings: Athrampattinam, Adhichanallur, and Keezhadi.

UNIT IV: BASIC THEORIES OF ANTHROPOLOGY

Evolutionary School of Thought, Diffusion School of Thought, Functionalism, Structure Functionalism, Structuralism, Symbolism, Culture and Personality, Postmodernism.

UNIT V: BASIC CONCEPTS OF ANTHROPOLOGY

Family: Universality of family - structure, organization, and functions of family - changes in Indian family, Hindu joint family system and its transition. Marriage: Definition of Marriage, Problems in Universal definition of Marriage - Marriage Regulations Exogamy and Endogamy - Types of Marriages - Preferential and Prescribed forms of marriage - Functions of Marriage - ways of Acquiring Mates, Marriage payments, Divorce, Marriage patterns in Hindu, Muslims and Christians. Kinship and Descent: Definition, Kinship in social structure, Terminology, types of kinship systems, Rules of Descent, Descent groups, kinship usages and Analysis of kinship. Culture: Definition, sub-culture, ethnocentrism, acculturation, assimilation, culture shock, culture loss, enculturation, patterns and configuration.

UNIT VI: ECONOMIC AND POLITICAL ANTHROPOLOGY

Meaning, scope and Relevance of Economic Anthropology; Principles governing production, distribution and consumption in communities subsisting on Hunting and gathering, Fishing, Pastoralism, Horticulture Agriculture and Industrial society. Modes of exchange, barter, ceremonial exchange, reciprocity, and redistribution, market and trade in tribal communities. Substantivism vs. Formalism.

Meaning and scope of Political Anthropology, power, leadership, Legitimacy - differences between State and Stateless societies. Social control system, Law and Justice in simple and contemporary societies, New States, Nation building.

UNIT VII: RESEARCH METHODS AND FIELD WORK TECHNIQUES

Fieldwork tradition in Anthropology, Participant Observation, Case Study, Focus Groups, Key informant interview, questionnaire and schedule, Genealogical method, Ethnographic approach, Visual Ethnography, Life histories and personal documents. Qualitative and Quantitative Research Methods, Basic statistics; graphical representation of data and sampling methods. Qualitative data analysis techniques: Content analysis, Narrative analysis and Discourse analysis. Writing culture and postmodernism.

UNIT VIII: SOCIAL STRATIFICATION AND RELIGION

Principles of social stratification, Caste, Class and Power systems, The basis of Indian social System: *varna*, *purushartha*, *karma* and rebirth.

Religion: Definition and functions of religion - Theories of origin of Religion – Religion and its forms, Animism, Animatism, Totemism, Naturalism, Monotheism, Polytheism- Different strands of religion, Folk, Popular and Classical- Religious Functionaries: Cult formation- Religion, Magic and Science, Totem and Taboo and their ritual significance- Religion and world view - Religion, Economy and political system.

UNIT IX: TRIBE AND THEIR CONTEMPORARY ISSUES IN INDIA

Definition of Tribe, Education, Health, Poverty, Land alienation, Issues of identity: Different Committees and their recommendations, island communities, PVTGs, Tribe and State conflict and compromise, Non-Scheduled Tribes, TRIs and their role in Tribal Development. Constitutional Safeguards for Scheduled Caste and Scheduled Tribes, Tribal Movements in India.

UNIT X: DEVELOPMENT ANTHROPOLOGY

Anthropology of Development and Developmental Anthropology, Applied Anthropology, Action Anthropology, Engaged Anthropology, Business Anthropology, Development Projects and Anthropological Contributions, Top down vs. Bottom up models, Participatory Approaches, Rapid Research Appraisals and other recent trends.

45. CHEMICAL TECHNOLOGY

(PG Degree Standard)

CODE: 290

UNIT I: PROCESS CALCULATIONS AND THERMODYNAMICS

Properties of liquids, solids and gases - Gas laws - Material and Energy balance, Material balance involving recycle by-pass and purge Thermodynamics functions - Chemical and Phase Equilibrium - Laws of Thermodynamics - Ideal and non-ideal gases and solutions, fugacity, correlation of activity coefficient, partial molal properties.

UNIT II: FLUID MECHANICS AND MECHANICAL OPERATIONS

Newtonian and non-Newtonian fluids, compressible and non - compressible fluids, flow through pipeline systems, flow in closed ducts, packed beds and fluidized bed. Continuity and conservation equations. Macroscopic energy balance, Bernoulli equation and its applications, Dimensional analysis, flow meters, pumps and compressors. Size reduction and size separation; laws of size reduction, Gravity settling, hindered settling sedimentation; centrifuges and cyclones; thickening and classification, filtration; mixing and agitation; thickening, elutriation, conveying of solids.

UNIT III: REACTION ENGINEERING, HEAT AND MASS TRANSFER

Rate equation, elementary and non-elementary reactions, theories of reaction rate and Prediction; Design equation for constant and variable volume batch reactors. Non-isothermal homogeneous reactor systems, adiabatic reactors, rates of heat exchanges for different reactors, The residence time distribution, basic models for non- ideal flow; conversion in non-ideal reactors. Fourier's law of heat conduction, convection and radiation, Heat transfer with phase change, heat exchangers, evaporation, Heat transfer in extended surfaces, Dimensional analysis in heat transfer, heat transfer coefficient for flow through a pipe, flow past flat plate, flow through packed beds. Radiative heat transfer – Black body radiation, Emissivity, Stefan - Boltzman law, Plank's law, radiation between surfaces. Diffusion, Theories of mass transfer, Analogy, inter-phase mass transfer. Distillation, absorption, leaching, liquid-liquid extraction, crystallization, adsorption, drying, humidification, de-humidification.

UNIT IV: PROCESS CONTROL AND INSTRUMENTAL METHODS OF ANALYSIS

Laplace transformation, application to solve ODEs. Dynamics of process elements, open loop and closed loop systems, principles of pneumatic and electronic controllers, Instrumentation: Sensors for Pressure, Flow, Temperature, Control valves, Computer Control of Processes, Analysis of control systems. Micro processor –based control. Spectroscopic analysis: Absorption spectroscopy, emission spectroscopy, mass spectroscopy, x-ray diffraction, color measurement by spectrometers, Gas analysis by thermal conductivity Moisture (humidity analysis) p^H measurements, Chromatography - H.P.L.C.

UNIT V: CHEMICAL PROCESSES

Nitration, Sulphonation and Sulfation, Hydrogenation, Halogenation & Oxidation, Kinetics and mechanism, the derivative reactions, Industrial applications, Raw material and manufacture of Soda ash, Sodium bicarbonate, Chlorine and Caustic soda, Bleaching powder, Calcium Hypochlorite; Sodium Hypochlorite; Sodium chloride or common salt, sodium sulfate, sodium bisulfate, or Niter cake, Sodium Bisulfite; Sodium Sulfite, Sodium Hydrosulfite; Sodium sulfide, Sodium Hydrosulfide, Sodium Thiosulfate; Sodium Nitrite; Sodium Silicates; Sodium peroxide, Sodium perborate; Sodium amide; Sodium cyanide and Ferri cyanide. Industrial alcohols, Beer, Wine, Butyl alcohol. Raw Materials, Manufacture of phosphoric acid, nitric acid, Sulfuric acid and HCL & the occurrence, Purification of all acids. Occurrences of oils, fats and waxes, classification, chemical composition, Extraction and refining oils and fats. Manufacture of edible oil. Surfactant : Concept of surface activity, Hydrophilic-lipophilic balance; Mechanism of detergency. Classification of surfactants; Biodegradation of surfactant; application of surfactants. Soap and Detergent: Soap, detergent, Glycerine: spentlye, synthetic glycerine manufacture and their applications Origin, Occurrence, exploration and classification of crude oils, Hydrocarbon, composition of petroleum and petroleum products (liquid and gas); Refining of crude oil, Catalytic cracking, thermal cracking; reforming. Chemical conversions, Extraction of Aromatics.

UNIT VI: PULP AND PAPER, AGROCHEMICALS AND FERTILIZERS

Classification and manufacture of Insecticides and pesticides, Plant derivatives, Pyrethrin, Nicotine, Rotenone, attractants and repellents, Fumigants, Nematacides, Acaricides, Fungicides, Industrial Biocides, Plant growth regulators, Herbicides. Raw material for fertilizers; Synthesis of ammonia, Ammonium nitrate, ammonium sulfate, Ammonium Phosphates; Urea, Super phosphates, Mixed fertilizers, organic fertilizers. Raw material for pulp, manufacture of pulp and paper. Hydrolysis of wood, Wood extractives. Cellulose; Hemi cellulose, lignin and associated materials. composition of cell walls. Physical and Chemical properties of cellulose and derivatives.

UNIT VII: PHARMACEUTICALS, POLYMERS, PLASTICS AND RUBBERS

Types of polymers, Thermoplastics and thermosetting plastics, Polymerization Types. Degradation of polymers through thermal, mechanical and chemical methods. Raw materials for polymers and resins. Chemistry of Natural resins and polymers such as lac, rosin, cellulose, rubber, proteins, fossil resins, etc. Preparation and applications of phenolics, amino resins, polyesters, polyamides, epoxides, polyurethanes, vinyls. Raw materials, manufacturing processes of plastics.

Composites: Raw materials, Comparison of different materials with composite; advantages and disadvantages of Natural rubber, synthetic rubber, rubber compounding, rubber fabrication; latex compound, rubber derivatives. Alkylations, Carboxylation and Acetylation; Condensation and Cyclization; Dehydration; Halogenation; Oxidation; Sulfonation; Amination; Complex Chemical Conversions. Fermentation and Life processing for antibiotics, Biologicals, Hormones and Vitamins, Biologicals, Steroids Hormones; Isolates from Plants and Animals.

UNIT VIII: COAL CHEMICALS AND INDUSTRIAL CARBON AND EXPLOSIVES

The destructive distillation of coal; Coking of coal; Distillation of coal tar; coal to Chemicals. Methods of manufacture and applications of Lampblack; carbon black; activated carbon; Natural graphite; Manufactured graphite and carbon; Industrial diamonds. Nuclear reactions: uranium and Thorium fission; Uranium as an energy source; nuclear fuels and processing. Types, Characteristics & Uses of explosive, Industrial Explosives.

UNIT IX: CERAMIC, GLASS, CEMENT AND LIME

Basic raw Materials; Chemical conversions, Including Basic Ceramic Chemistry; White wares: Structural Clay products; Refractories; Specialized Ceramic products: Vitreous Enamel; Kiln, Composition, manufacture of specialty glasses. Portland cement: Raw materials & Manufacture of Portland cements; Setting and Hardening of cement; Manufacture and use of Lime and Gypsum.

UNIT X: FOOD AND FOOD BY- PRODUCTS

Classification and structure of carbohydrates, Physical and chemical properties of sugar, starch, pectin substances, gum and other polysaccharide, Functional properties of carbohydrates in foods, Definition and classification of lipids, chemistry of fatty acids and glycerides. Functional properties of lipids in foods, structure and chemistry of amino acids, peptides and proteins, Source and distribution of proteins, Isolation, identification and purity of proteins. Texture of fruits and vegetables, Plant pigments, Effects of cooking on texture and composition of fruits and vegetables Animal proteins, Structure and chemical composition of muscles. Composition of milk, Physical and chemical properties of milk proteins and effects, chemistry of milk products like cheese, cream, butter, ghee, etc.

46. COMPUTER SCIENCE (PG Degree Standard)

CODE: 287

UNIT I: MATHEMATICAL FOUNDATIONS

AUTOMATA, LANGUAGES AND COMPUTATION Basic concepts of strings, alphabets, languages, finite automaton, regular expressions, Moore and Mealy machines, regular sets, minimization of finite automata, Chomsky hierarchy of languages, relation between classes of languages, context free grammar, pushdown automata, Linear bounded automata, Turing machines, halting problem and decidability.

DESIGN AND ANALYSIS OF ALGORITHMS Design Techniques, divide and conquer, greedy method, dynamic programming etc., graph algorithms, Strassen's matrix multiplication algorithm, geometric algorithms, NP complete problems, approximation algorithms.

UNIT II: COMPUTER ARCHITECTURE

Review of elements of Computer organisation - Machine instructions, addressing modes, instruction pipelining, memory organization. CPU and system buses, bus standards, Von Neumann Vs Non Von Neumann architectures, language directed architectures, RISC architectures, object oriented architectures, memory and I/O subsystems - Hierarchical memory, virtual memory system memory allocation and management, cache memories, I/O subsystems, architectural classification, pipelined processors, vector processing. Array processors, multiprocessor architectures.

UNIT III: DATA STRUCTURES IN C++

Data types, control statements, procedures, Scope rules, arrays and records, enumerated data types, sets, pointers, recursion. Sequential, indexed files, sorting and merging report generations. Arrays, queues, linked lists, stacks, tree traversal, evaluation of expressions using postfix notation, sorting algorithms, bubble sort, quicksort, heap sort, complexity of algorithms.

UNIT IV: COMPILERS AND ADVANCED OPERATING SYSTEMS

Assemblers loaders, linkers, macro processor, text editors, programming languages, lexical analysis, parsing techniques, precedence grammars, symbol tables, scope rules and parameter passing mechanisms, syntax directed translation, run time environment, machine code generation, interpreter.

ADVANCED OPERATING SYSTEMS (a) **Review of uniprocessor operating system:** Batch, multiprogramming and time-sharing systems, operating system concepts, memory, device and file management, process scheduling, interprocess communication, process synchronization and concurrency, deadlocks, protection.

(b) **Multiprocessor operating system:** Classification of multiprocessor operating systems, software and operating system requirements for multiprocessors, multiprocessor scheduling strategies. (c) **Distributed Operating System:** Communication in distributed systems, client server model, remote procedure call, group communication, synchronization in distributed systems, mutual exclusion and election algorithms,

deadlocks in distributed systems, processor allocation algorithms, scheduling in distributed system, distributed file systems.

UNIT V: DATABASE MANAGEMENT SYSTEMS

Elements of data base systems, file organization, relational and network data models, normal forms, query languages. Design and implementation of typical database systems, Internal and external consistency, concurrency control techniques, object oriented data bases.

UNIT VI: MOBILE COMMUNICATIONS

Mobile IP: Goals – Packet Delivery – Strategies – Registration – Tunneling and Reverse Tunneling – Adhoc Networks – Routing Strategies.

WIRELESS APPLICATION PROTOCOL [WAP] – Architecture – XML – WML Script – Applications.

UNIT VII: SOFTWARE PROJECT MANAGEMENT

Software Project Planning: Size Estimation - Cost Estimation Models - The Constructive Cost Model (COCOMO)-COCOMO II - The Putnam Resource Allocation Models -Software Risk Managements.

UNIT VIII: MULTIMEDIA AND WEB TECHNOLOGIES

Uses of Multimedia – Introduction to making multimedia – Multimedia skills. Multimedia hardware and software – Connections – Memory and storage devices – Input devices – Output devices – Communication devices. Basic software tools – Text editing and word processing tools – Painting and drawing tools – 3-D modelling and animation tools – Image editing tools – Animation, video and digital movie tools. Making instant multimedia – Multimedia authoring tools. Multimedia Building Blocks – Text – Sound – Multimedia System Sounds – MIDI versus Digital Audio – Digital Audio – Making MIDI Audio – Audio File Formats – Production tips - Images – Animation - Video.

The world wide web: Browsing the Web - Web address - Web browser basics - Strong and managing (book marks) - Surfing the web with web browser - Searching the web directory - Search engines - Navigation tools.

Email: Sending - Reading - Replying - Deleting - Exiting - Sending Mail to more than one person sending folder - Forwarding a mail - Checking the spelling - Attachments. **HTML:** Overview of HTML - Adding structure to a page formatting text and pages - Linking page to the world - Including picture - Clearing lists - Arranging items within tables - Getting feedback from form - Splitting a page into frames.

UNIT IX: OBJECT ORIENTED ANALYSIS AND DESIGN

Unified Modeling Language [UML] - Diagrams - Class - Use case - Naming Classes - Identifying Objects, Relationships, Attributes, Methods - Association - Super and Sub Class Relationship - Aggregation.

UNIT X: ADVANCED TOPICS: ARTIFICIAL INTELLIGENCE, CLOUD COMPUTING, CYBER SECURITY

Artificial Intelligence: Production systems, different strategies, hill climbing, backtracking, graph search specialised production systems, minimax procedure, alphabeta pruning, resolution and refutation, control strategies, structured representation of knowledge, semantic nets, frames.

Cloud Computing: Architecture - Deployment Models - Application Virtualization -Hardware Virtualization.

Network Security: Potential Attacks to Computer System – Cryptography – Authentication – Access Control – Digital Signatures.

47. COMPUTER APPLICATION **(PG Degree Standard)**

CODE: 289

UNIT I: MATHEMATICAL FOUNDATIONS

Set Theory, Principles of mathematical Induction, Relations, Functions, Algebraic structure - Semigroup, monoid, group, propositional calculus generating functions and graph theory.

UNIT II: COMPUTER ARCHITECTURE

Review of elements of Computer organisation - Machine instructions, addressing modes, instruction pipelining, memory organization. CPU and system buses, bus standards, Von Neumann Vs Non Von Neumann architectures, language directed architectures, RISC architectures, object oriented architectures, memory and I/O subsystems - Hierarchical memory, virtual memory system memory allocation and management, cache memories, I/O subsystems, architectural classification, pipelined processors, vector processing. Array processors, multiprocessor architectures.

UNIT III: PROGRAMMING AND DATA STRUCTURES [C AND C++]

Arrays, Stacks, Strings, Queues, Lists, Graphs, Trees and Sets, Graph and Tree Traversals, Recursion, Tree balancing, Hashing, File structures, Sorting and Searching, Algorithm design and Analysis techniques.

UNIT IV: SYSTEMS ANALYSIS AND DESIGN

Introduction – Definition of a System – Characteristics of a system – Elements of Systems Analysis – System development life cycle – Software crisis – Role of Systems Analyst – **Project Selection** : Project request – Managing Project selection – Preliminary investigation – Problem classification and definition – **Feasibility study** : Types of feasibility – Investigative study – Cost Benefit Analysis – Fact finding techniques – DFD – Data Dictionaries – HIPO – Decision tables and Decision Trees – Warnier Orr Diagrams.

UNIT V: COMPILER DESIGN

Assemblers, loaders, linkers, macroprocessor, text editors, programming languages, lexical analysis, parsing techniques, precedence grammars, symbol tables, scope rules and parameter passing mechanisms, syntax directed translation, run time environment, machine code generation, interpreters.

UNIT VI: ADVANCED DATABASES

Elements of data base systems, file organization, relational and network data models, normal forms, query languages. Design and implementation of typical database systems, Internal and external consistency, concurrency control techniques, object oriented data bases.

UNIT VII: SOFTWARE ENGINEERING

Systems analysis, detailed analysis, feasibility study, tools for system designer, input and output design, program definition, module design and design review, structured programming and conversion, testing, training and documentation, systems life cycle, role of System Analyst. Tools for office Automation, word processing Spreadsheets, Financial and Statistical packages, payroll, inventory, picture generation and display in computers, Multimedia systems, Application of computers in Government, Defence, Agriculture, Medicine and Education.

UNIT VIII: COMPUTER GRAPHICS

Introduction – Point plotting techniques – Line drawing displays – Two dimensional displays – Clipping and Windowing. Graphics package – Segmented display files – Display file compilation – Geometric models – Picture structure. Graphical input units – graphical input techniques – Event handling – Input functions. Raster graphics fundamentals – Solid area scan conversion – Interactive raster graphics – Raster graphics systems – Raster display hardware. Two dimensional and three dimensional transformations.

UNIT IX: MULTIMEDIA AND WEB TECHNOLOGIES

Uses of Multimedia – Introduction to making multimedia – Multimedia skills. Multimedia hardware and software – Connections – Memory and storage devices – Input devices – Output devices – Communication devices. Basic software tools – Text editing and word processing tools – Painting and drawing tools – 3-D modelling and animation tools – Image editing tools – Animation, video and digital movie tools. Making instant multimedia – Multimedia authoring tools. Multimedia Building Blocks – Text – Sound – Multimedia System Sounds – MIDI versus Digital Audio – Digital Audio – Making MIDI Audio – Audio File Formats – Production tips - Images – Animation - Video.

The world wide web: Browsing the Web - Web address - Web browser basics - Strong and managing(book marks) - Surfing the web with web browser - Searching the web directory - Search engines - Navigation tools.

Email: Sending - Reading - Replying - Deleting - Exiting - Sending Mail to more than one person sending folder - Forwarding a mail - Checking the spelling - Attachments. **HTML:** Overview of HTML - Adding structure to a page formatting text and pages - Linking page to the world - Including picture - Clearing lists - Arranging items within tables - Getting feedback from form - Splitting a page into frames

UNIT X: MANAGEMENT OF SOFTWARE PROJECTS

Software Project Planning: Size Estimation - Cost Estimation Models - The Constructive Cost Model (COCOMO)-COCOMO II - The Putnam Resource Allocation Models -Software Risk Managements.

48. FINANCIAL AND COST ACCOUNTANCY

(Intermediate Standard)

CODE: 433

UNIT I: ACCOUNTING

- 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 organisations and incomplete records e) Computerised Accounting System

UNIT II: AUDITING

- 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

- 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

- 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

- a) Canons of Taxation
- b) Goods and Services Tax (GST) a. CGST-SGST-IGST-Cess b. 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

- 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

- 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: BOOKKEEPING AND METHODS

- 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

- 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

- a) Concepts, Types of Budgets
- b) Budgetary Control Vs Standard Costing
- c) Advantages and Limitations
- d) Preparation of Various Budgets
- e) Zero Base Budgeting

49. TOWN AND COUNTRY PLANNING

Single Paper Consisting of the subjects Town Planning (PG Degree Standard), Civil Engineering (Degree Standard) & Architecture (Degree Standard)

CODE: 382

UNIT I: INTRODUCTION TO PLANNING – SCOPE AND CONTENT

Planning System in India, Regional Plan, Master Plan, Structure Plan, Detailed Development Plans, City Corporate Plan and Smart City Plan. New Town concepts, case studies in India & U.K. – Concept of Region, Types of Region, Techniques of Regional Analysis, Growth Model, Regional disparities, Resources in Regional development. Multi-level Planning – Regional Planning in India, Regional Plan case Studies, USA, U.K., Japan.

UNIT II: PLANNING THEORY AND TECHNIQUES

Process of evolution of human settlement planning - Principles in Planning – Rationality in Planning, Blueprint and Process mode, Disjointed Incremental mode of Planning, Normative versus Functional mode of Planning – Type of planning surveys, data identification for various plan preparation. Delphi, Trade off-game, Simulation models, Gravity analysis, Lowry model, Threshold analysis, Multivariate analysis – Optimization and economic analysis methods in project formulation and implementation, PBBS – URDPFI Guidelines.

UNIT III: URBAN SOCIOLOGY, ECONOMICS, GEOGRAPHY: THEORIES AND APPLICATIONS

Socio-economic groups, structures and Institutions as related to urban and rural communities - 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.

UNIT IV: ENVIRONMENTAL ISSUES RELATED TO PLANNING

Components of Environment – Classification of Environmental Resources - Purpose and Objectives in Environmental Protection - Institutional and Legal Support in management of the Environment – Environmental Policies, and issues -Environmental Impact Assessment Practice in India - Types, Conceptual Approach and Phases of EIA – Impact Identification - Public Participation in the Process of Environmental Decision Making Process - Environmental Concepts – Sustainable Planning – Eco Cities, Compact Cities, Smart growth, Sponge city, IGBC Rating Systems applicable for Towns.

UNIT V: URBAN INFRASTRUCTURE NET WORK PLANNING ISSUES

Obligatory and Discretionary Services, Implication of Urban Form and Size on Services, Norms and Standards, National Building Code, 2016. National and Local guidelines – Demand Strategy, Issues and Tasks, Operation and Management Aspects of each Service - Water Supply, Sewerage / Drainage, Solid Waste Management, Roads and Street Lighting - Priority, Placement Network Options, Effective System Analysis – Private and Public partnership and innovative concepts and practices in Infrastructure Development.

UNIT VI: PROJECT FORMULATION AND IMPLEMENTATION

Types of Project, Project Cycle, Identification, Selection, Preparation - Capital Investment Programme, Internal Rate of Return, Net present Value - Cost- Benefit & Analysis, Social Cost Benefit analysis, Budgeting, Tamil Nadu Transparency in Tender Rules - Appraisal techniques – Project Proposal and objectives, Current base line conditions, Financial and Economical Appraisal, Socio cultural assessment - Process Monitoring – Key issues, Monitoring Schedule, Data collection, Design, strategy, Impact Evaluation – Approaches, Key issues, Alternative to large scale qualitative Evaluation designs.

UNIT VII: PLANNING LEGISLATION AND LEGAL FRAMEWORK

The concept of law, Indian Constitution. Rights of Ownership and development of property. Statutory control as a positive tool in plan preparation and implementation - Evolution, scope and Significance of Planning Legislation. History and survey of development of planning legislation in India - Panchayat Act, Municipality Act, Corporation Act, TNULB Act, Land Acquisition, Rehabilitation and Resettlement Act, 2013. Provisions in the above acts related to functions, powers, role and responsibilities of local bodies including elected representatives and officers - 73rd and 74th CAA and their implications on planning and development. Local Body finance, revenue, expenditure and resource mobilization - T & C Planning Act of Tamil Nadu 1971, The Ancient Monuments and Archaeological Sites and Remains Act, Tamilnadu Combined Development and Building rules 2019, The TamilNadu street vendors scheme, The Tamil Nadu Real Estate (Regulation and Development) Act, 2016.

UNIT VIII: ISSUES IN TRAFFIC AND TRANSPORTATION PLANNING

Highway classification - Traffic characteristics – Horizontal and Vertical alignment, Land use & Transportation relationships - Sight distance – Cross- sectional elements – at grade and Grade separated intersections - Volume Count – Origin and Destination – Parking and Public Transport - Surveys – Inventory of Transport facilities – Methods of Survey – Different modes – Capacities – Limitations – Planning Aspects - Coordination – 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

UNIT IX: REMOTE SENSING AND G.I.S., IN PLANNING

Basics of Remote Sensing and GIS. - Classification of spatial and nonspatial data application of spatial data in urban and regional planning - Identification of required 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.

UNIT X: CURRENT TRENDS AND ISSUES IN PLANNING

Concepts of sustainable urban development, sustainable Transportation, E – Governance, HRIDAY, Rurban Mission, Swach Bharat Mission, AMRUT, National Health Mission, 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.

50. PHARMACY / PHARMACEUTICAL SCIENCES

(Degree Standard)

CODE: 429

UNIT I:

- 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: 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) Surface & interfacial Phenomenon: Measurement of surface and interfacial tensions, spreading coefficient, surface active agents, HLB Scale, solubilisation and Detergency
- 4) pH, buffers and isotonic solution: pH determination, applications of buffers, buffer equation, buffer capacity and buffered isotonic solutions.
- 5) Unit Operations: Size reduction, size separation, mixing, filtration, centrifugation evaporation, drying, distillation, heat transfer, compression and Tablet coating.
- 6) 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.
- 7) Micromeritics: Particle size distribution, mean particle size, number and weight distribution, particle number, methods of determining particle size by different methods, specific surface, methods of determining surface area and derived properties of powders.
- 8) 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, shape, flow 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.
- 9) Pharmaceutical Excipients – Used in Liquid, Semisolids and solid dosage forms.
- 10) Quality Control Tests and Evaluation parameters of the following formulations: Solid dosage forms, Semi solids, Liquid dosage forms, Parenteral, Ophthalmic preparation and Pharmaceutical Aerosols.
- 11) Cosmetics: Formulation and preparation of the following cosmetics preparations Lipsticks, Shampoos, Cold Cream, Vanishing Cream, Tooth Paste, Hair Dyes and Sunscreens.
- 12) 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.
- 13) 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.
- 14) Pharmacokinetics: Definition and introduction to 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 - KE, $T_{1/2}$, Vd, AUC, Ka, CLt and CLR – definitions, methods of elimination, understanding of their significance and application.
- 15) Good manufacturing practices (GMP)
- 16) 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.

- 17) Warehousing: Good Warehousing practice, Materials Management.
- 18) Pilot Plant Scale up Techniques: General considerations – including significance of personnel requirements, space requirements, raw materials, Pilot plant scale up considerations for solids, liquid orals, semi solids and relevant documentation, SUPAC guidelines, Introduction to platform technology.
- 19) 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.
- 20) Indian Regulatory Requirements: Central Drug Standard Control Organisation (CDSCO) and State Licensing Authority, Organisation, Responsibilities, Certificate of Pharmaceutical products (COPP) Regulatory requirements and approval procedures for New drugs.
- 21) Over the counter (OTC) Sales: Introduction and sale of over the counter and Rational use of common over the counter medications.
- 22) 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.
- 23) 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.

UNIT II:

- 1) Study of principle, procedure, merits, demerits and applications of physical, chemical, gaseous, radiation and mechanical method of sterilization. Evaluation of the efficiency of sterilization methods. Sterility indicators.
- 2) Classification and mode of action of disinfectants, factors influencing disinfection, antiseptics and their evaluation, for bacteriostatic and bactericidal actions. Sterility Testing of Products (solids, liquids, Ophthalmic and other Sterile products) according to IP, BP and USP
- 3) Principles and methods of different microbiological assay. Methods for standardization of Antibiotics, Vitamins and Amino acids.
- 4) Types of immunity - humoral immunity, cellular immunity
- 5) Blood products and Plasma Substitutes: Collection, Processing and Storage of whole human blood, dried human plasma, plasma Substitutes 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:

- 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.
- 5) Metal hydride reduction, Wolff kishnar reduction, Clemenson's reduction, Beckmann and Schmidt rearrangement, Oppenauer Oxidation, Claisen-Schmidt condensation.

UNIT IV:

- 1) Chemistry, synthesis and Medicinal uses of the following categories of drugs - Local Anaesthetics, Drugs acting on CNS, ANS, CVS, Anti-infective agents like Sulphonamides, Antibiotics, AntiTB, Anti-Viral, Antiprotozoal, Antifungal, Antimalarials, Antineoplastic agents, Antihistaminics, Diuretics.
- 2) QSAR studies, various approaches in drug design.

UNIT V:

- 1) Principles and Pharmacopeial Assay Procedures involving Non-aqueous Titration, Redox, Diazotization, complexometric methods, electrometric titration, gravimetric analysis.
- 2) Chromatography- TLC, Column, Paper, GC, Ion exchange, HPLC, HPTLC, Gel electrophoresis.
- 3) Theory, principle, instrumentation and applications of colorimetry, UV- Visible Spectrophotometry, Spectrofluorimetry, Nepheloturbidometry, IR, Mass, NMR, RIA, Polarimetry, Refractometry, Thermal method of analysis - TGA, DSC, DTA, atomic absorption spectroscopy.
- 4) ICH guidelines- Calibration and validation, calibration of electronic balance, UV spectrophotometer, IR spectrophotometer, Fluorimeter, HPLC, GC, Flame photometer.

UNIT VI:

a. General Pharmacology:- Definition, Sources of drugs, essential drugs concept, routes of drug administration, agonist, antagonist, membrane transport, absorption, distribution, metabolism and excretion of drugs. Enzyme induction, enzyme inhibition. Principles and mechanism of drug action, Classification of receptors, drug receptor interactions, Signal transduction mechanisms, dose response relationship, therapeutic index, combined effects of drug & factors modifying drug action. Adverse drug reactions, Drug interactions, Drug discovery and clinical evaluation of new drugs, Pharmacovigilance.

b. Pharmacology of Drugs acting on central nervous system: General anaesthetics and Pre anaesthetic medication, Sedatives and Hypnotics, centrally acting muscle relaxants, Anti- epileptics, Alcohols and disulfiram, Anti-Psychotics, Anti-depressants, anti-anxiety agents, anti-manics and hallucinogens, Drugs used in Parkinson's disease and Alzheimer's disease, CNS-Stimulants and nootropics, Opioid analgesics and antagonists, Drug Addiction, drug abuse, drug tolerance and drug dependence.

c. Pharmacology of Drugs acting on Peripheral nervous system: Neurohumoral transmission in Autonomic nervous system, Para Sympathomimetics, Parasympatholytics, Sympathomimetics, Sympatholytics, neuromuscular blocking agents, Skeletal muscle relaxants (peripheral), Local anaesthetic agents, Drug used in Myasthenia gravis and glaucoma.

d. Pharmacology of Drugs acting on cardio vascular system: Drugs used in congestive heart failure, Anti-hypertensive drugs, Anti-Anginal Drugs, Anti-arrhythmic drugs, Anti-hyperlipidemic drugs, Drugs used in the therapy of shock, Hematinics, Coagulants and anti-coagulants, Fibrinolytics and anti-platelet drugs, Plasma Volume expanders.

e. Pharmacology of drugs acting on urinary system: Diuretics and Anti-diuretics.

f. Pharmacology of drug acting on respiratory system: Anti-asthmatic drugs, Drugs used in the management of COPD [Chronic Obstructive Pulmonary disease], Expectorants, anti-tussives, nasal decongestants, Respiratory Stimulants.

g. Immuno Pharmacology: Immuno stimulants, immuno suppressants, bio-similars.

h. Bio-assay: Principles and applications of Bio-assay, types of bio-assay, bio-assay of insulin, oxytocin, Vasopressin, ACTH, d-tubocurarine, digitalis, histamine and 5 HT.

i. Chrono Pharmacology: Definition of rhythm and cycles, Biological clock and its significance

UNIT VII:

a) Pharmacology of Drugs acting on the Gastrointestinal tract: Anti-ulcer agents, Drugs for constipation and diarrhoea, appetite stimulants and Suppressants, Digestants and carminatives, Emetics and anti-emetics.

b) Pharmacology of drugs acting on endocrine system: Anterior Pituitary hormones – analogues and their inhibitors, Thyroid hormones analogues and their inhibitors, Parathormone, Calcitonin, Vitamin-D, Insulin, oral-hypo glycaemic agents and glucagon. Adrenocorticotrophic hormone [ACTH] and corticosteroids, Androgens and Anabolic Steroids, Estrogens, Progesterone, Oral Contraceptives. Drugs acting on uterus.

c) Autocoids and related drugs: Histamine, 5-HT and their antagonists, Prostaglandins, Thromboxanes and Leukotrienes, Angiotensin, Bradykinin and Substance-P, Non-Steroidal antiinflammatory drugs, Anti-gout drugs, Anti-rheumatic drugs.

d) Chemotherapy: General Principles of chemotherapy, Sulfonamides and co-trimoxazole, Antibiotics: Penicillins, Cephalosporins, Chloramphenicol, macrolides, Quinolones and fluoroquinolones, tetracycline and amino glycosides, Anti-tubercular agents, Anti-leprotic agents, Anti-fungal agents, Anti-viral drugs, Anthelmintics, Antimalarial drugs, Anti-amoebic agents, Urinary tract infection and sexually transmitted diseases, Chemotherapy of malignancy.

e) Principles of toxicology: Acute, Sub-acute, Chronic toxicity, genotoxicity, carcinogenicity, teratogenicity, mutagenicity, General Principles of treatment of poisoning, clinical symptoms and management of barbiturates, morphine, organophosphorus compound, lead, mercury and arsenic poisoning.

UNIT VIII:

- a) Alphabetical, Morphological, Taxonomical, Chemical and Pharmacological classification of crude drugs.
- b) Adulteration of drugs of natural origin, Evaluation by Organoleptic, Microscopic, Physical, Chemical and Biological methods.
- c) Plant hormones and their applications.
- d) Types of plant tissue culture, nutritional requirements, growth and their maintenance. Application of plant tissue culture in pharmacognosy.
- e) Brief study of basic metabolic pathways and formation of different Secondary metabolites through these pathways - Shikimic acid pathway, Acetate mevalonate pathway.

UNIT IX:

- a) General introduction, composition, chemistry and chemical classification, general methods of extraction and analysis, bio-sources, therapeutic uses and commercial application of following Secondary metabolites.

Alkaloids : Vinca, Rauwolfia, Belladonna, Opium Steroids, Cardiac glycosides and Triterpenoids : Liquorice, Dioscorea, Digitalis Volatile oils : Mentha, Clove, Cinnamon, Fennel,

Coriander Tannins : Black & Pale catechu Resins : Benzoin, Ginger, Asafoetida, Colophony Glycosides : Senna, Aloes

- b) Isolation, Identification & Analysis of following Phytoconstituents i) Terpenoids : Menthol, Citral, Artemisin ii) Glycosides : Glycyrrhetic acid, Rutin iii) Alkaloids : Atropine, Quinine, Reserpine, Caffeine iv) Resins: Podophyllotoxin, Curcumin
- c) Modern methods of extraction, application of latest techniques like Spectroscopy, Chromatography and Electrophoresis in isolation, purification and identification of Crude drugs.
- d) Basic principles involved in Homeopathy systems of medicine.

UNIT X:

- a) The Drugs and Cosmetics Act, 1940 and Drugs Rules 1945 (As Amended from time to time)
- b) The Drugs and Magic Remedies (Objectionable Advertisement) Act, 1954 and Rules, 1955 (As Amended from time to time)
- c) The Drugs (Price Control) Order 2013 (As Amended from time to time)
- d) The Narcotic Drugs and Psychotropic substances Act and Rules, 1985 (As Amended from time to time)
- e) The Pharmacy Act, 1948 (As Amended from time to time)

51.SANSKRIT**(PG Degree Standard)****CODE: 319****Unit I: Vedas and Vedāngas**

Vedic and Classical periods - Vedas classification of the Deities glorified in the Vedas, Vedic Texts - Samhitā, Brāhmaṇa, Aranyaka portions, the recession of the four Vedas - Upaniṣads- Major and minor - Vedāngas - The Six supplements śikṣā, Vyākaraṇa, Chandas, Nirukta, Jyotiṣa and Kalpa Vedic Indices.

Unit II: Epics and Purāṇas

Epics Rāmāyaṇa Features of the epic literature- Authorship of the Rāmāyaṇa date Influence of Ramayaṇa on later Sanskrit Literature; Mahābhārata- Three Stages in the development of the Epic - Date-Critical Estimate as a Dharma śāstra Harivaṁśa- Upākhyānas Influence of Mahābhārata on later Sanskrit Literature - Rāmāyaṇa and Mahābhārata as the National epics of India.

Purāṇas- Definition Authorship Date Importance - Classification Brief account of the Puranas - Upapurāṇas.

Unit III: Pre Kālidāsa Kāvya Period - Kālidāsa - Post Kālidāsa Kāvya

Definition of Kavya - Characteristic Features of the Mahākāvya- Vālmiki - Vararuci -Pingala.

Kalidasa - Date of Kālidāsa - Raghuvamśa, Kumārasambhava.

Post Kālidāsa Kāvya

Aśvaghoṣa Renaissance theory Inscriptions Sethubandha Janaki Haraṇa - Kirātārjunīyam - Śiṣupālavadham - Naiṣadīyacaritam.

Unit IV: Lyric - Gnostic and Didactic Poetry - Didactic fable Anthology - Popular tale- Prose - Campū Literature

Features of the lyrics Erotic Lyrics - Meghasandeśa - Amaruśataka Gitagovindaand others -Devotional Lyrics- General Features works of Sankara, Rāmānuja and Vedāntadeśika - Nārāyaṇīyam - Karuṇālahari Gnostic and Didactic General Features Origin and development works of Bhaṭṭaphari and Kṣemendra - Anyāpadāśa,

Anthology: Features-Gātāsaptasati - Sadukti karṇāmṛta

Didactic fable-General Features - Pañcatantra and Hitopadeśa

Prose Definition Katha and ākhyāyikā Vāsavadatta, Daśakumāracarita, Kathāsaritsāgara. Origin Kādambari,

Campū- definition Rāmāyanacampū Bharatacampū.

Popular tale - General features - Brhatkatha- language form-contents and date - abridgements-Buddhist tales- stories of Vikramaditya and others.

Unit V: Sanskrit Drama- Origin- Characteristics Types, Bhāsa and Kālidāsa- Post Kālidāsa Dramatists

Traditional view about the origin of Drama early beginning - Greek origin Definition and Characteristic Features Uparūpaka. Types of Rūpaka and

Bhāsa and Kālidāsa Trivandrum plays their authorship Abhijñānaśākuntala.

Post Kālidāsa Dramatists śūdraka Dinnāga

Viśākadatta Harṣavardhana- Bhaṭṭanārāyaṇa Bhavabhūti Murari Rājaśekhara and others - Allegorical lays of kṛṣṇamiśra and Vedānta Deśika.

History Paucity of works on history discussed -Harṣacarita Rajatharangni-and others.

Unit VI: Theories of Poetry and Drama

Sāhitya Alaṅkāra - Theories main and subsidiary. Bharata Dandin - Bhamaha Vāmana -ānandavardhana Abhinavagupta Rājaśekhara - Dhananjaya Bhoja- Kṣemendra Mammaṭa Ruyyaka- Appayadikṣita Jagannatha Pandita-Jayadeva- Their works on Alaṅkāraśāstra and theories formulated by them.

Unit VII: Grammar - Texts and Concepts

Grammar Pānini -Kātyāyanas Patañjali Bhartṛhari- Bhaṭṭojidīkṣita - Nāgeśaand others. Sphoṭa theory. (Concepts: Samjñā, Paribhāṣa, Sandhi, Samāsa, and Kāraka) Taddhita Krdanta Strīpratyaya from Siddhānta Kaumudī.

Unit VIII: Prosody and Lexicography, Astronomy, Dharmaśāstra,

Upaveda- ayurveda- Gandharvaveda Dhanurveda Arthaśāstra and Ancillary Sciences.

Prosody - Vṛtta and jāti. Lexicons on Homonyms and Synonyms.

Astronomy - General Features Early Treatises Five Siddhāntas- Indian Mathematics; Varahamihira aryabhatta Brahmagupta Bhāskarācārya.

Scope of the Upavedas - ayurveda General Principles, Nature of treatment - Caraka - śuśruta - Vāgbhaṭa - Kāmaśāstra -Gandharvaveda - Dance and music - Dhanurveda, Arthaśāstra-Architecture - Painting.

Unit IX: Bharatiya Darśanas (Indian Philosophy), Religion General Principles

Explanation and Scope of Philosophy - Nāstika and Astika systems -

Nāstika - Cārvaka, Buddhism, Jainism ; **Āstika**- Nyaya- Vaiśeṣika, Sāṃkhya, Yoga, Mīmāṃsā - Pūrva and Uttaramīmāṃsā on later Sanskrit Literature a- sūtra texts and Commentaries - Independent treatises of these systems.

Unit X: Epigraphy - Manuscriptology

Inscriptions, Scripts used in Ancient Texts - Grantha, Tamil, Devanagari, Nandināgari, Brāhmī and śāradā Scripts - Editing of Sanskrit Texts from manuscripts - Preservation of manuscripts materials used, Deciphering of scripts Textual Errors: Omissions, Deletions, additions. Use of modern Technology to edit texts

52. LAW
(Degree Standard)

CODE: 414

UNIT I: CONSTITUTIONAL LAW AND HUMAN RIGHTS

Defining Constitution, Constitutional Law, Constitutionalism, Transformative Constitutionalism – Constitutional Conventions - Salient features of the Indian Constitution, Concept of State – Writs - Judicial Review – Fundamental Rights – Directive Principles of State Policy–Fundamental Duties – Contractual and Tortious liability of the State – Compensatory Jurisprudence – Services – Administrative Tribunals – Right to Information – Role of Judiciary and Human Rights – National and State Human Rights Commissions.

UNIT II: JURISPRUDENCE

Evolution of Law – Ancient India, Greek and Roman Civilization – Law, Morals, Ethics and Justice – Nature of law – Functions of Law - Rule of Law

- Authority - Autonomy - Anarchy - Obligation - Opinion - Dictum–Law as a Social Fact -Nature and Scope of Jurisprudence – From Police State to Welfare State.

Schools of Jurisprudence – Analytical – Historical – Philosophical – Sociological - Western Thoughts and Indian Jurisprudence – Social Transformation and Social Justice - Local Law & Global Law - Civil Law & Common Law - Cultural & Technical aspects - Micro & Macro aspects.

Definition of Law – Kinds of Law – Nature and Functions of State – State and Sovereignty – Relationship with Law and State - Sources of Law – Classical and Modern Sources – Convention, Custom, Legislation, Precedent and its kinds – Stare Decisis, Ratio Decidendi and Obiter Dicta - Administration of Justice – Complete Justice – Theories of Justice.

Meaning, Definition and kinds of Rights and Duties – Jural Correlatives and Jural Opposites - Person and its kinds – Status and Theories of Corporate personality - Title and its kinds – Ownership– meaning and its kinds – Possession – meaning and its kinds - Liability – meaning and its kinds – Negligence – meaning and its kinds – Obligation–meaning and its kinds – Law of Procedure – Elements of Judicial Procedure – Evidence - Property – Meaning and its kinds.

Application of Law and Interpretation of Law - Codification of Customary Law and Enforcement mechanism – Writ Remedies – Public Interest Litigation – Justice Delivery System – Judicial Activism and Judicial process.

UNIT III: LAW RELATING TO INDUSTRIAL RELATIONS

Industrial Disputes Act, 1947 – Definitions – Industry, Industrial Dispute, Workman – Appropriate Government - Authorities – Investigation and Dispute Settlement machineries – Conciliation - Arbitration – Adjudication – Reference of disputes – Conciliation Board – Conciliation Officer – Labour Court – Tribunal, National Tribunal – Court of Inquiry – Award–Settlement – powers of the adjudicatory authorities - Strike, Lock-out - Lay-off, Retrenchment, Closure and Transfer of undertaking - Unfair Labour Practices - Recovery of money due from an Employer – Penalties.

Trade Unions Act, 1926 – Definitions – Registration of Trade Unions – Members – Office Bearers – Rights and Liabilities – Privileges and Immunities – Recognition of Trade Union.

Industrial Employment (Standing Orders) Act, 1946– Appointment, Jurisdiction, Powers and Duties of Certifying officers – Procedure for certification of Standing Orders – Operation and Binding Effect of Certified Standing Orders – Modification – Appeal – Registration of Standing Orders – Temporary Application of Model Standing Orders – Interpretation of Standing Orders - Subsistence Allowance.

Misconduct – Domestic Enquiry and Disciplinary Proceedings – Appropriate Relief in case of Termination, Discharge, Dismissal.

UNIT IV: LAW RELATING TO WAGES

Payment of Wages Act, 1936 – Definitions - Obligations of the Employer– Deductions – Authorities– Settlement of Claims – Inspectors – Powers – Offences and Penalties.

Minimum Wages Act, 1948– Definitions – Fixation and Revision of minimum rates of wages – Methods – Committees and Advisory Boards – Settlement of Claims - Inspectors – Offences and Penalties.

Payment of Bonus Act, 1965– Definitions – Coverage – Kinds of Bonus – Eligibility and extent of bonus – Calculation of Bonus – Available and Allocable surplus – Set on and Set off – Forfeiture of Bonus – Recovery of Bonus – Powers and Functions of Inspectors.

Equal Remuneration Act, 1976– Definitions – Duty of employer – Work of same and similar nature – Advisory Committee - Hearing and deciding claims and complaints – Inspectors – Penalties.

UNIT V: LAW RELATING TO SOCIAL SECURITY

Employees' Compensation Act, 1923 – Definitions – Liability of the employer to pay compensation – Personal injury– Accident - Arising out of and in the course of employment – Doctrine of Notional Extension – Occupational disease – Notice and Claims – Determination and Distribution of Compensation – Commissioner – Powers and Functions.

Employees' State Insurance Act, 1948 – Definitions – ESI Corporation – Standing Committee – Medical Benefit Council – ESI Fund – Contributions – Benefits – Adjudication of Dispute and Claims – Penalties.

Employees' Provident Funds and Miscellaneous Provisions Act, 1952 – Definitions – Central and State Board of Trustees - Provident Fund Scheme – Family Pension Scheme – Deposit Linked Insurance Scheme – Contributions – Determination of Money due from Employees - Authorities under the Act – Powers and Functions – Offences and Penalties.

Maternity Benefit Act, 1961 – Definitions – Eligibility – Maternity Benefit and certain other benefits under the Act – Notice of Claim – Prohibition against Dismissal and Wage Deduction – Inspectors – powers and duties.

Payment of Gratuity Act, 1972 – Definitions – Payment of Gratuity – Eligibility – Amount of Gratuity – Forfeiture of gratuity - Determination of gratuity amount – Recovery of gratuity – Compulsory Insurance - Controlling authority – Offences and Penalties.

Factories Act, 1948 – Definitions – Registration – Provisions relating to Health, Safety and Welfare - Special provisions relating to hazardous processes – Working hours of Adults – Regulation of employment of women and children – Annual leave with wages – Penalties and Procedure.

Motor Transport Workers Act, 1961 – Definitions, Registration of motor transport undertakings – Inspectors – Certifying surgeons – Welfare and Health – Hours and Limitation of employment – Employment of young persons - Wages and leave – Penalties and Procedure.

UNIT VI: ADMINISTRATIVE LAW

Introduction to Administrative Law – Role of State from Laissez-Faire to Welfare State – Definition, Nature and Scope of Administrative Law - Relationship Between Administrative Law and Constitutional Law – Rule of Law - Doctrine of Separation of Powers - System of checks and balances – Classification of Administrative Actions.

Delegated Legislation – Need for Delegated Legislation – Delegated Legislation in India – Pre and Post Constitutional Period – Constitutionality of Delegated Legislation – Essential Legislative Function – Permissible and impermissible limits of Delegated Legislation - Control over Delegated Legislation – Judicial, Procedural and Legislative Control.

Need for Administrative Adjudication - Reason for growth of Administrative Tribunals - Procedure and powers of Administrative Tribunal – Tribunal under Constitution – High Court's Superintendence over Tribunals – Administrative Tribunals under Administrative Tribunals Act, 1985.

Principles of Natural Justice – Concept - Rule against Bias - Audi Alteram Partem – Exceptions to the Rule of Natural Justice

Judicial Review and Liability of the State - Judicial Review of Administrative Action through Writs - Kinds of Writs - Grounds for issue of Writs - Administrative Discretion - Nature and need of Administrative discretion - Grounds and Extent of Judicial Review of Administrative discretion – Doctrine of proportionality – Privileges and Immunities of Government in Legal Proceedings – Privilege to withhold documents – Miscellaneous Privileges of the Government - Notice, Limitation, Enforcement of Court Order - Binding nature of Statutes over the States action – Promissory Estoppel - Doctrine of Legitimate Expectation – Right to Information – Liability of State in Torts and Contracts.

Maladministration and Alternative Remedies - Ombudsman in England - Ombudsman in India – Lokpal – Lokayukta in States - Central Vigilance Commission.

Public Undertakings - Rights, Duties and Liabilities of Public Corporations - Controls over Public Corporations, Government Control, Parliamentary Control, Judicial Control, Public Control – Role of Ombudsman in Public Undertaking.

UNIT VII: LAW OF CONTRACTS AND TRANSFER OF PROPERTY ACT

Essentials of Contracts – Valid, Void, Voidable - Discharge of Contracts – Quasi Contracts Damages – Compensation – Indemnity – Guarantee – Bailment – Lien – Partnership Act and Limited Liability Partnership - Specific Relief Act.

Mortgage – Definition and Kinds – Rights and Liabilities of Mortgagor and Mortgagee – Doctrine of Equity of Redemption – Collateral Advantages – Doctrine of Marshalling, Contribution and Subrogation – Charge & Lease – Differences.

UNIT VIII: COMPANY LAW & BANKING LAW

Companies Act, 2013 - Definition - Characteristic of a Company - Types of Companies - Formation of a Company – Memorandum of Association, Articles of Association – Registration of charges – Formation of CSR Committee – Management of the company – AGM – Ordinary resolution & Special resolutions - Appointment & Qualification of Directors - Meeting of the Board and its powers – Quorum of the Board - Appointment of independent Directors – Duties of Director – Key Managerial personnel and promoter - Powers of Shareholders - Norms for accepting deposits from the Public – adjudicatory powers of Official Liquidator – procedure for merger and amalgamation – procedure for merging foreign company with an Indian company - process of rehabilitation and liquidation of the companies in case of financial crisis - Winding-up– Winding-up by Tribunals – Voluntary Winding-up.

National Company Law Tribunal and Appellate Tribunal.

Banking Law – Banker and Customer – Rights and Duties of Banker – Law relating to Loans, Advances and Investments by Banks.

Negotiable Instruments Act, 1881 - Definition and Characteristics – Parties to Negotiable instruments – Discharge and dishonor of instruments – Liability – Cheques – Civil and Criminal Liability for dishonor of cheque under Sec.138 to Sec.142 of the Amended Negotiable Instruments Act.

State Financial Corporation's Act, 1951 (SFCs Act) - Important Definitions viz., Board, Development Bank, Financial Corporation, Industrial concern - Powers and Duties of the Board – Rights available to Financial corporation to enforce securities in case of default - Power to call for repayment before agreed period - Special provisions for enforcement of claims by Financial Corporation - Procedure of District Judge in respect of applications – Recovery of amounts due to the Financial Corporation as an arrear of land revenue.

The Securitisation and Reconstruction of Financial Assets & Enforcement of Security Interest [SARFAESI] Act, 2002 - Important Definitions – Brief overview of the SARFAESI Act – Applicability of the SARFAESI Act - Features of SARFAESI Act – Procedure of the SARFAESI Act – Methods for recovery under SARFAESI Act – Enforcing security interests, i.e., seizing the assets pledged as collateral security for the loan – Significance of the SARFAESI Act – Shortcomings and lacunae in the SARFAESI Act – Central Registry - Recent amendments in SARFAESI Act.

Recovery of Debts and Bankruptcy Act, 1993 - The Debts Recovery Tribunals [DRTs] and Debts Recovery Appellate Tribunals [DRATs] - Jurisdiction, Powers and Authority of Tribunals – Procedure of Tribunals – Recovery of Debts determined by Tribunal – Insolvency and Bankruptcy Code, 2016.

UNIT IX: PROCEDURAL LAW

Plaint, Written Statement – Suits in General – Admission – Execution – Reference, Review, Revision – Brief History about the Criminal procedure code – definition – Classes of Criminal Courts – Processes to compel appearance – Summons, warrant of arrest – Jurisdiction of Criminal Courts in Inquiries and Trials – Trial Procedure – Appeals, Reference in Criminal Cases – General provisions regarding execution – Levy of Fine – The Contempt of Courts Act, 1971.

UNIT X: OTHER LAWS

Penal Code – General explanations – General exceptions – offences against property.

Indian Evidence Act, 1872 – Scope, object and applicability of Indian evidence act and exclusion – Relevance of facts and admissibility of facts – Facts which need not be proved – Judicial notice – Burden of Proof – Types of evidence – presumptions.

Family Law in India – Law of Marriage and Divorce: Hindu, Muslim & Christian Law and Recent Developments – Law of Adoption – Hindu Adoption with Special Reference to the Juristic Concept and Development of Case Laws – Changes brought by Hindu Adoption and Maintenance Act, 1956 – Hindu Minority and Guardianship Act – Maintenance – Contemporary Changes – Muslim Law of Legitimacy – Acknowledgement of Paternity.

Motor Vehicles Act, 1988 – State Transport undertakings – Accident Claims Tribunals – No Fault Liability – Offences, Penalties and Procedure, Insurance of Motor Vehicles against third party risks – Recent amendments.

Consumer Law -Consumer Protection Act and its developments - Consumer, Complaint, Complainant – Consumer Rights – Filing of Complaints – Consumer Redressal Forums – Jurisdiction, Powers and Functions – Recent Amendments.

Annexure IV

Instructions to be followed by candidates while appearing for written examinations

1. General Instructions

1.1. 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.

1.2. 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.

1.3. 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.

1.4. 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.

1.5. Parents and others who accompany the candidates will not be permitted inside the examination venue.

1.6. If the photograph of the candidate in the memorandum of admission (hall ticket) 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 License / Permanent Account Number (PAN) card / Voter ID card, to the Chief Invigilator, who shall countersign it.

1.7. The ID 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.

1.8. In order to facilitate verification of the identity of the candidates and explanation of the procedures pertaining to the examination, the candidates shall present themselves at the examination venue one hour before the time scheduled for the commencement of the examination.

1.9. All gates serving as entry into the examination venue shall be closed thirty minutes before the commencement of the examination and no one shall be allowed into the venue thereafter. (e.g., in case of forenoon session, for an examination scheduled to commence at 09.30 am, the candidates should present themselves at 09.00 am in the examination venue. In case of afternoon session, for an examination scheduled to commence at 02.00 pm, the candidates should present themselves at 01.30 pm. After that no candidate shall be permitted to enter the premises of the examination venue).

1.10. 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.

1.11. 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.

1.12. Candidates must show the memorandum of admission (hall ticket) to the Invigilator / Chief Invigilator / inspection authorities / any authorized persons of the examination hall, on demand, for verification.

1.13. Candidates must ensure that the Room Invigilator signs in the memorandum of admission (hall ticket). 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 for by the Commission.

1.14 The memorandum of admission may also be photo copied, as a precaution, after the exam is over.

1.15. No duplicate memorandum of admission (hallticket) will be issued later.

1.16. Candidates should maintain strict discipline not only in the examination room, but also inside the campus of the examination venue. Candidates found smoking / in toxicated, 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.

1.17. Water, tea, coffee, snacks, soft drinks, etc., will not be allowed inside the examination venue.

1.18. 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.

1.19. An alarm bell shall be sounded in respect of each of the following activities in order to alert the candidates. The room invigilators shall make appropriate announcements as and when required.

Event	Timeline	Duration of Bell
Before Commencement of Examination		
Objective type Examination: Distribution of OMR Answer Sheets Distribution of Question Booklets	30 minutes before 15 minutes before	Short Bell (2 seconds) Short Bell (2 seconds)
Descriptive type Examination: Distribution of Question-cum- Answer Booklets	15 minutes before	Short Bell (2 seconds)
At the Start and During the Examination		
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)
At the Conclusion and After the Examination		
Conclusion of the Examination	At the Designated Time	Long Bell (5 seconds)
After Conclusion of the Examination	15 minutes after	Long Bell (5 seconds)

1.20. The candidates shall compulsorily be seated in the examination room thirty minutes before the time scheduled for the commencement of the examination.

1.21. Candidates must sit in the place allotted to them after checking the name, register number and photo as pasted on the table.

1.22. Candidates must follow the instructions from the invigilators regarding filling up of OMR answer sheets

2. Objective Type Examination

2.1. Candidates must carry only black 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.

2.2. The OMR answer sheet as well as instructions regarding filling up of the same, shall be given thirty minutes before the time scheduled for the commencement of the objective type examination.

2.3. Pre-printed personalized OMR answer sheets containing photograph, name, register number, subject and examination centre and venue, date and session as mentioned in the memorandum of admission (hall ticket) will be supplied in the examination room. 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.

2.4. Candidates shall shade all 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.

2.5. Candidates shall affix their signature at the two designated places in the answer sheet. One signature shall be affixed after having read the instructions therein, before the commencement of the examination and the other signature shall be affixed, after the conclusion of the examination.

2.6. Candidates shall affix his/her left hand thumb impression in the appropriate box provided in the answer paper, after the examination is over.

2.7. Candidates will be supplied with the question booklet fifteen minutes before commencement of the examination.

2.8. Candidates must not tick mark / mark the answers in the question booklet. Failure to comply with this instruction will result in rejection of candidature.

2.9. Before writing and shading 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. Correct Question Booklet Number which is used by the candidate shall be written in the OMR answer sheet. If any defect is noticed in the question booklet or OMR answer sheet after the commencement of the examination, it will not be replaced.

2.10. After checking the OMR answer sheet and the question booklet for discrepancies, candidates must sign in the attendance sheet, after verifying his name and register number therein, duly mentioning the question booklet number.

2.11. The candidates must write and shade the Question Booklet Number correctly in the bubbles provided in the OMR answer sheet. The OMR answer sheets will be evaluated based on the Question Booklet Number shaded by the candidates in the bubbles.

2.12. The correct method of shading Question Booklet Number is illustrated below. For example, if the Question Booklet Number is 27430896:

SECTION - II / பித்தி-II

CANDIDATE TO FILL THIS AREA FIRST
Write your Booklet series and shade the Circle with Blue or Black Ballpoint Pen only.

2	7	4	3	0	8	9	6
0	0	0	0	0	0	0	0
1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9

2.13. If the Question Booklet Number shaded by the candidate is not read by the OMR scanner, which may be due to improper or absence of shading of Question Booklet Number by the candidates, such answer sheets shall not be subjected to evaluation. Therefore, the said answer sheets shall be invalidated.

2.14. Candidates must shade only one of the answer bubbles in the OMR answer sheet, for each question. In case more than one bubble is shaded for a particular question, that answer shall not be evaluated.

2.15. There shall be no question for which none of the answer bubbles remains unshaded. In case none of the answer bubbles is shaded, for any question(s), the answer sheet shall be invalidated. Option [E] should be shaded if the answer is not known to the candidate. The total number of [A]s, [B]s, [C]s, [D]s and [E]s shaded as answers should be written in the boxes and the corresponding bubbles should be shaded by the candidates against Section III of Part II of the OMR answer sheet. The total number of [A]s + [B]s + [C]s + [D]s + [E]s shaded should be equal to the total number of questions printed in the question booklet.

2.16. The correct method of writing & shading in section – III (a) & section III (b) of the Part – II of OMR Answer Sheet is illustrated below:

For eg., 36 [A]s are shaded as answers in Response portion, then 036 shall be written in the boxes provided in Section – III (a) and the corresponding bubbles 0,3 and 6 should be shaded in Section – III (b) as illustrated below:

A

0	3	6
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

2.17. The room invigilator shall fill in Section IV of Part II, the number of As, Bs, Cs, Ds and Es, as shaded by the candidate in Section III (b) of the OMR answer sheet. Both the invigilator and the candidate must sign below this entry after the examination is over.

2.18. Fifteen minutes extra time shall be given after the examination exclusively for this activity.

2.19. Only upon completion of these procedures, candidates shall be permitted to leave the examination room.

2.20. The video regarding the instructions to candidates appearing for the objective type examinations is available in <https://www.tnpsc.gov.in/English/omr-guidelines.html>

3. Descriptive type examination

3.1. 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.

3.2. In respect of descriptive type examination, 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.

3.3. Candidates must sign in the attendance sheet, after verifying his name and register number therein, duly mentioning the question-cum-answer booklet number.

3.4. 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.

3.5. 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.

4. Computer Based Test (CBT) Examination

4.1. The Registration for the examination shall start one hour before the time scheduled for the commencement of the examination. Further, the candidates should present themselves at the examination venue 30 minutes before the time scheduled for the commencement of examination and no one shall be allowed into the venue thereafter.

4.2. Each candidate will be assigned a Computer to take up the examination.

4.3. 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.

4.4. Candidates will be provided with a user name and pass word to login the system.

4.5. Use the key board only to key-in the Register Number, User id (registration id) and password.

4.6. Necessary instructions will be displayed on the screen. Kindly read all the instructions carefully and follow the instructions without fail.

4.7. In case of doubt in the questions and answers, English version is the final.

- 4.8. In Computer Based Test, questions with five options each will be displayed in the computer screen.
- 4.9. The Question and optional answers will be shuffled randomly and displayed to the candidate.
- 4.10. Candidates will be provided with a paper for doing rough work. After closure of the examination, rough sheet will be collected.
- 4.11. Candidate has to click the best answer to the question. Candidates can proceed to the next question by clicking next button or previous question by clicking previous button.
- 4.12. Candidate can use only the mouse to select the correct answers and proceed with answering the questions.
- 4.13. 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.
- 4.14. Candidate can submit their answers at any time during the examination.
- 4.15. If he/she wants to close the examination, he/ she shall remain in these at till the completion of the scheduled time of examination.
- 4.16. Once the entire answers are submitted, the candidates have no option to proceed further.
- 4.17. If the candidates fail to submit their answers, the system will automatically submit the answers to the server, at the closure of the examination.
- 4.18. The question and answers can be zoomed to the required level for the candidates with visual impairment.
- 4.19. Candidates have to sign the attendance sheet and affix thumb impression for verification of his / her identity.
- 4.20. All the activities of the candidates with the mouse will be recorded in the server and a log file will be created for future reference.
- 4.21. The Examination Hall will be under camera surveillance.
- 4.22. 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) 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.
- 4.23. Answer sheet answered other than the subject opted by the candidate in the online application / specified in the Hall Ticket will be invalidated.
- 4.24. One question will be displayed on the screen at a time
- 4.25. 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.

4.26. Question Number Box: 1. 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.

4.27. 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.

4.28. The questions will appear on the screen in ascending order, which can be answered one by one.

4.29. To select your answer of a question, click on the button of one of the options.

4.30. Click on Save and Next button after answering every question to save your answer. Otherwise your answer will not be saved.

4.31. To deselect your chosen answer, click on the button of the chosen option again or click on the Clear Response button.

4.32. 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.

4.33. Any attempt of malpractice found, will render you liable to such penal action as the Commission may decide.

5. Other Instructions

5.1. Borrowing of any material, instruments from other candidates is strictly prohibited. Candidates shall use only their own pens and specifically permitted material.

5.2. Candidates shall not be allowed to exceed the time allotted for answering the paper, for any reason.

5.3. In the descriptive type of examination, the candidate is to write answers in question cum answer booklet.

5.4. Tentative answer keys will be hosted in the Commission's website within twenty six working days from the date of conduct of objective type examination. Candidates can challenge the tentative answer keys of the objective type examination through the 'Answer Key Challenge' window available in the Commission's website [Results → 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.

5.5. 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.

5.6. 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 paper evaluation shall commence thereafter.

5.7. The Commission shall not publish the final answer key until the completion of the entire selection process.

5.8. Requests from candidates for furnishing of their marks or answer paper copy before the completion of the entire selection process, will not be entertained by the Commission.

5.9. After conclusion of the entire selection process, copies of 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.

5.10. After conclusion of the entire selection process, relevant particulars of all candidates who had applied for recruitment to the post shall be made available on the Commission's website.

6. Special Instructions for Persons with Benchmark Disabilities, Usage of scribes

6.1. Candidates with benchmark 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.

6.1.1. Candidate with benchmark disability in the category of blindness, locomotor disability (both arm affected) and cerebral palsy the facility of scribe shall be given.

6.1.2. In case of other category of disability, the provision of scribe can be allowed on production of a certificate from the Chief Medical Officer / Civil Surgeon / Medical Superintendent of a Government Health care institution if so desired by that candidate. The format of the certificate is given below:

Certificate

This is 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. Exemption from Tamil / Second Language.
2. Extra ____ hours for writing theory exam.
3. Allocation of a scribe.
4. Over looking spelling mistakes and grammatical errors.
5. Using calculator/assistive devices
6. _____(Any other assistive devices or concessions).

*strike out the non applicable.

Signature

(Name of Government Hospital/ Civil Surgeon/ Medical Superintendent/ Signature of the notified Medical Authority of a Government Health Care Institution)

Name & Designation

Name of Government Hospital/ Health Care Centre/ The notified Medical Authority

Place:

Date:

Signature / Thumb impression of the Differently Abled Person

(Photo of the
Differently Abled
Person and Stamp
to be fixed here)

Note:

Certificate should be given by a specialist of the relevant stream / disability
(e.g. Visual Impairment–Ophthalmologist, Locomotor disability–Orthopedic Specialist / PMR etc.,)

6.1.3. 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.

6.2. All candidates with benchmark 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.

6.3. Candidates with Benchmark disability must affix their signature and left hand thumb impression in the space provided in the answer sheets, if possible.

6.4. Visually disabled / orthopedically disabled candidates who have been permitted to use scribe facility, who are unable to affix their signature, may affix their left hand thumb impression alone.

6.5. Candidates who are unable to use their left hand, must affix right hand thumb impression.

6.6. 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.

6.7. Compensatory time of not less than 20 minutes per hour of examination will be allowed to candidates with benchmark disability, who have physical limitation to write including that of speed and who are utilizing the services of a scribe.

6.8. All candidates with 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 which could further be increased on a case-to-case basis.

6.9. 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 Invigilators control room.

7. 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:

7.1. Invalidation of Answer Sheet (Objective Type)

7.1.1. Usage of any pen other than black ball point pen.

7.1.2. Usage of pencil.

7.1.3. Answered in a subject other than the one opted for in the online application / specified in the memorandum of admission (hall ticket).

7.1.4. In case of non-personalized OMR answer sheet, if the register number is not written in the space provided for it.

7.1.5. The answers are not shaded as per the correct method illustrated on page 2 of the OMR answer sheet.

7.1.6. If the Barcode / OMR-track printed on page 1 of the OMR answer sheet is tampered with.

7.1.7. OMR answer sheet is not signed by the candidate at all required places.

7.1.8. Required particulars in the OMR answer sheet have not been filled up.

7.1.9. Wrongly seated in the place of other candidates and/or written the examination using the OMR answer sheet of other candidates.

7.1.10. If any irrelevant / impertinent remarks amounting to disclosure of identity is found in the OMR answer sheet upon physical verification.

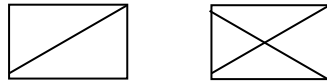
7.1.11. If the bubbles for Question Booklet Number are not shaded.

7.1.12. Even if one or more bubble / bubbles of Question Booklet Number are left blank (not shaded) in the space provided in Section-II of part-II of OMR answer sheet.

7.1.13. If more than one bubble / bubbles is shaded in space provided for bubbles of Question Booklet Number in each column (Multiple Shading)

7.1.14. Question Booklet Number shaded in bubbles provided for Question Booklet Number by the candidate is out of question booklet number series printed [Not in range of QB series]

7.1.15. If either Part-I or Part-II or both of OMR Answer Sheet is crossed out. For Example: OMR Sheet



7.1.16. In cases, where a candidate attends two or more subject papers and if one of the subject papers is invalidated for having violated the Commission's instructions to applicants and if the General Studies paper is not invalidated, the remaining subject papers will be evaluated. However, if the General Studies paper is invalidated for having violated the Commission's instructions to applicants, all the subject papers attended will not be evaluated.

7.1.17. In cases, where a candidate is issued with Memorandum of admission (hall ticket) for attending two or more subject papers and if he/she absents himself/herself for one of the subject papers but attends the remaining subject papers and also General Studies paper, all the papers attended will be evaluated. However, if the candidate absents himself/herself for the General Studies paper, all the papers attended will not be evaluated.

7.2. Invalidation of Answer Sheet (Descriptive Type)

7.2.1. 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.

7.2.2. Usage of whitener, sketch pens, pencil, colour pencils, multicolour pens, crayons or any other writing materials, for any purpose.

7.2.3. 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.

7.2.4. Appealing to the examiner in the answer booklet, invoking sympathy of examiners in connection with their results.

7.2.5. Candidates writing anything unconnected to the question, or any impertinent remarks and irrelevant matter revealing his identity.

7.2.6. 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.

7.2.7. Wrongly seated in the place of other candidates and / or written the examination using the answer booklet of other candidates.

7.2.8. Tampering with the Bar code printed on the question-cum-answer booklet.

7.2.9. The Question cum Answer Booklet which has not been signed by the candidates in the designated places.

7.3. Deduction of Marks (Objective Type)

7.3.1. In case of non-personalised OMR answer sheet, two marks will be deducted for writing the register number incorrectly.

7.3.2. In case number of [As], [Bs], [Cs], [Ds] and [Es] count wrongly mentioned / not shaded / incorrectly shaded by the candidate in the Part – II of the OMR Answer Sheet, two marks will be deducted from the total marks obtained by the candidate.

7.3.3. None of the answer bubbles is shaded for even one question by the candidate, two marks will be deducted from the total marks obtained by the candidate.

7.3.4. In case of absence of Candidates left thumb impression in answered portion of the OMR answer sheet, two marks will be deducted from the total marks obtained by the candidate.

7.3.5. If the Question Booklet Number is not written or partially written in the space provided, five marks will be deducted from the total marks obtained by the candidates.

7.4. Criminal Action: Criminal action will be initiated against the candidates for the following reasons

7.4.1. 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 Question Cum Answer Booklet and debarment for any period the Commission may deem fit, as well as appropriate criminal action.

7.4.2. 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.

7.5. Invalidation of 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 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 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 Question Cum Answer Booklet without handing it over to the room invigilator.

h. Tampering with the Barcode printed on the Question Cum Answer Booklet.

7.6. Violation of any one or more of the instructions contained in the Commission's Instructions to Applicants / instructions printed on the question-cum-answer booklet / 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 invalidation of answer sheet and/or any other penalty, as decided by the Commission.

7.7. Debarment: The period or 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 papers, 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 Government or Quasi-Government organizations, local bodies, public sector undertakings, statutory bodies, public corporations, Universities, etc., (iii) Criminal cases, arrests, convictions, disciplinary proceedings, etc. Debarment or disqualification by Union Public Service Commission / State Public Service Commission / other agencies	One Year
4.	Possession of electronic devices such as cellular phones, watches 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, hand bags, 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/ handwritten, etc.	Three Years
7.	In addition to the offences list edhere in, the involvement of candidates in any In discipline or irregular practices within/ outside the examination room.	Three Years
8.	Written certain un warranted 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

Annexure-V

1. Experience Certificate for the post of Assistant Geologist in Geology and Mining Department (Post Code: 1863)

1.	Name of the Employee	
2.	Father / Spouse Name	
3.	Date of Birth	
4.	Qualification possessed by the Employee on the date of joining Service.	
5.	Designation of the Employee	
6.	Nature of the Work / Duty performed by the Employee (To be mentioned in brief)	
7.	Period of Practical Experience in Field work	From ____ (date) To ____ (date)
8.	Total Experience (YY/MM/DD)	____ years ____ months ____ days
9.	Whether Attendance Register / Attendance Rolls / Pay Register and other records available	Yes / No
10.	Name of the Organisation / Institution	
11.	Address of the Organisation / Institution	
12.	Phone No. and Email ID of the Organisation / Institution	

This is to certify that Thiru/Tmt./Selvi possesses the practical experience in field work as stated above, as on the date of notification (i.e.26.07.2024). The above particulars furnished by me are correct.

Affix photograph of the employee with the signature of the Certifying Authority on the Photograph

Seal of Office / Officer:

Place
Date:

Signature
Name & Designation of the
Head of Organization / Institution /
Competent Authority

Note:

1. A certificate in the format prescribed should be obtained from the Head of the Organization/ Institution wherein the individual had served or the authority competent to issue such certificate.
2. The Competent authority who issues the certificate is cautioned that issuing of certificate which contains false or incorrect details will lead to legal / penal action against them.

**2. Experience Certificate for the post of Chemist in Industries and Commerce Department
(Post Code: 1913)**

1.	Name of the Employee	
2.	Father / Spouse Name	
3.	Date of Birth	
4.	Qualification possessed by the Employee on the date of joining service	
5.	Designation of the Employee	
6.	Nature of the Work / Duty performed by the Employee (To be mentioned in brief)	
7.	Period of Research Experience in Pure or Applied Chemistry or Analytical Chemistry	From ____ (date) To ____ (date)
8.	Total Experience (YY/MM/DD)	____ years ____ months ____ days
9.	Whether Attendance Register / Attendance Rolls / Pay Register and other records available for this Employee	Yes / No
10.	Name of the Organisation / Institution	
11.	Address of the Organisation / Institution	
12.	Phone No. and Email ID of the Organisation / Institution	

This is to certify that Thiru/Tmt./Selvi possesses the **experience in research in Pure or Applied Chemistry or Analytical Chemistry** as stated above, as on the date of notification (i.e.26.07.2024). The above particulars furnished by me are correct.

Affix photograph of the employee with the signature of the Certifying Authority on the Photograph

Signature
Name & Designation of the
Head of Organisation / Institution /
Competent Authority

Place: Seal of Office / Officer
Date:

Note:

1. A certificate in the format prescribed should be obtained from the Head of the Institution where in the individual had served or the authority competent to issue such certificate.
2. The Competent authority who issues the certificate is cautioned that issuing of certificate which contains false or incorrect details will lead to legal/ penal action against them.

3. Experience Certificate for the post of Junior Analyst in Drugs Testing Laboratory in Drugs Control Administration Department

(Post Code: 2006)

1.	Name of the Employee	
2.	Father / Spouse Name	
3.	Date of Birth	
4.	Qualification possessed by the Employee on the date of joining service	
5.	Designation of the Employee	
6.	Nature of the Work / Duty performed by the Employee (To be mentioned in brief)	
7.	Period of Experience	From ____ (date) To ____ (date)
8.	Total Experience (YY/MM/DD)	____ years ____ months ____ days
9.	Whether Attendance Register / Attendance Rolls / Pay Register and other records available for this Employee	Yes / No
10.	Name of the Organisation / Institution	
11.	Type of Organisation/ Institution	
12.	Address of the Organisation / Institution	
13.	Phone No. and Email ID of the Organisation / Institution	

This is to certify that Thiru/Tmt./Selvi possesses the **experience in analysis of drugs** as stated above, as on the date of notification (i.e.26.07.2024). The above particulars furnished by me are correct.

Affix photograph of the employee with the signature of the Certifying Authority on the Photograph

Signature
Name & Designation of the
Head of Organisation / Institution /
Competent Authority

Place: _____ Seal of Office / Officer
Date: _____

Note:

1. A certificate in the format prescribed should be obtained from the Head of the Institution / Organization wherein the individual had served or the authority competent to issue such certificate.
2. The Competent authority who issues the certificate is cautioned that issuing of certificate which contains false or incorrect details will lead to legal/ penal action against them.

**4. Experience Certificate for the post of Junior Chemist in Industries and Commerce Department
(Post Code: 1914)**

1.	Name of the Employee	
2.	Father / Spouse Name	
3.	Date of Birth	
4.	Qualification possessed by the Employee on the date of joining Service.	
5.	Designation of the Employee	
6.	Nature of the Work / Duty performed by the Employee (To be mentioned in brief)	
7.	Period of Experience	From ____ (date) To ____ (date)
8.	Total Experience (YY/MM/DD)	____ years ____ months ____ days
9.	Whether Attendance Register / Attendance Rolls / Pay Register and other records available	Yes / No
10.	Name of the Organisation / Institution	
11.	Type of Organisation/ Institution (Research Laboratory/ Analytical or Metallurgical Laboratory)	
12.	a. Is the Research Laboratory recognised by the Ministry of Science and Technology, Government of India?	Yes/No/NA
	b. Is the Analytical/ Metallurgical Laboratory engaged in testing and Analytical and issues Test Certificate?	Yes/No/NA
13.	Address of the Organisation / Institution	
14.	Phone No. and Email ID of the Organisation / Institution	

This is to certify that Thiru/Tmt./Selvi possesses the **experience** as stated above, as on the date of notification (i.e.26.07.2024). The above particulars furnished by me are correct.

Affix photograph of the employee with the signature of the Certifying Authority on the Photograph

Seal of Office / Officer:

Place
Date:

Signature
Name & Designation of the
Head of Organization / Institution /
Competent Authority

Note:

1. A certificate in the format prescribed should be obtained from the Head of the Organization/ Institution wherein the individual had served or the authority competent to issue such certificate.
2. The Competent authority who issues the certificate is cautioned that issuing of certificate which contains false or incorrect details will lead to legal / penal action against them.

**5. Experience Certificate for the post of Curator in Department of Museums
(Post Code: 2127)**

1.	Name of the candidate	
2.	Father / Spouse Name	
3.	Date of Birth	
4.	Qualification possessed by the candidate on the date of joining the Organisation	
5.	Designation of the Employee	
6.	Details of Scientific publications done by the candidate	
7.	Nature of the Work / Duty performed by the Candidate (To be mentioned in brief)	
8.	Period of Research Experience	From ____ (date) To ____ (date)
9.	Total Experience (YY/MM/DD)	____ years ____ months ____ days
10.	Whether Attendance Register / Attendance Rolls and other records available	Yes / No
11.	Name of the Organisation / Institution	
12.	Type of Organisation/ Institution	
13.	Address of the Organisation / Institution	
14.	Phone No. and Email ID of the Organisation / Institution	

This is to certify that Thiru/Tmt./Selvi possesses the **research experience with scientific publication** as stated above, as on the date of notification (i.e.26.07.2024). The above particulars furnished by me are correct.

Affix photograph of the employee with the signature of the Certifying Authority on the Photograph

Seal of Office / Officer:

Place
Date:

Signature
Name & Designation of the
Head of Organization / Institution /
Competent Authority

Note:

1. A certificate in the format prescribed should be obtained from the Head of the Organization/ Institution wherein the individual had served or the authority competent to issue such certificate.
2. The Competent authority who issues the certificate is cautioned that issuing of certificate which contains false or incorrect details will lead to legal / penal action against them.

**6. Experience Certificate for the post of Foreman (Marine) in Fisheries and Fishermen Welfare
Department
(Post Code: 1762)**

1.	Name of the Employee	
2.	Father / Spouse Name	
3.	Date of Birth	
4.	Qualification possessed by the Employee on the date of joining service	
5.	Designation of the Employee	
6.	Nature of the Work / Duty performed by the Candidate (To be mentioned in brief)	
7.	Give details of experience possessed by the Candidate	Workshop/Handling diesel engine/Handling marine diesel engine
8.	Period of Experience	From ____ (date) To ____ (date)
9.	Total Experience (YY/MM/DD)	____ years ____ months ____ days
10.	Whether Attendance Register / Attendance Rolls / Pay Register and other records available for this Employee	Yes / No
11.	Name of the Organisation / Institution	
12.	Type of Organisation/ Institution	
13.	Address of the Organisation / Institution	
14.	Phone No. and Email ID of the Organisation / Institution	

This is to certify that Thiru/Tmt./Selvi possesses the **experience in workshop / handling diesel engine / handling marine diesel engine*** as stated above, as on the date of notification (i.e.26.07.2024). The above particulars furnished by me are correct.

* Strike out whichever is not applicable

Affix photograph of the employee with the signature of the Certifying Authority on the Photograph

Seal of Office / Officer:

Place
Date:

Signature
Name & Designation of the
Head of Organization / Institution /
Competent Authority

Note:

1. A certificate in the format prescribed should be obtained from the Head of the Organization/ Institution wherein the individual had served or the authority competent to issue such certificate.
2. The Competent authority who issues the certificate is cautioned that issuing of certificate which contains false or incorrect details will lead to legal / penal action against them.

**7. Experience Certificate for the post of Store Keeper in Forensic Sciences Department
(Post Code: 1768)**

1.	Name of the Employee	
2.	Father / Spouse Name	
3.	Date of Birth	
4.	Qualification possessed by the Employee on the date of joining service	
5.	Designation of the Employee	
6.	Nature of the Work / Duty performed by the Employee (To be mentioned in brief)s	
7.	Period of Experience	From ____ (date) To ____ (date)
8.	Total Experience (YY/MM/DD)	____ years ____ months ____ days
9.	Whether Attendance Register / Attendance Rolls / Pay Register and other records available for this Employee	Yes / No
10.	Name of the Organisation / Institution	
11.	Type of Organisation/ Institution Reputed firm / Government institution	
12.	Address of the Organisation / Institution	
13.	Phone No. and Email ID of the Organisation / Institution	

This is to certify that Thiru/Tmt./Selvi possesses the **experience as Store Keeper** as stated above, as on the date of notification (i.e.26.07.2024). The above particulars furnished by me are correct.

Affix photograph of the employee with the signature of the Certifying Authority on the Photograph

Signature
Name & Designation of the
Head of Organisation / Institution /
Competent Authority

Place: Seal of Office / Officer
Date:

Note:

1. A certificate in the format prescribed should be obtained from the Head of the Organization/ Institution wherein the individual had served or the authority competent to issue such certificate.
2. The Competent authority who issues the certificate is cautioned that issuing of certificate which contains false or in correct details will lead to legal / penal action against them.