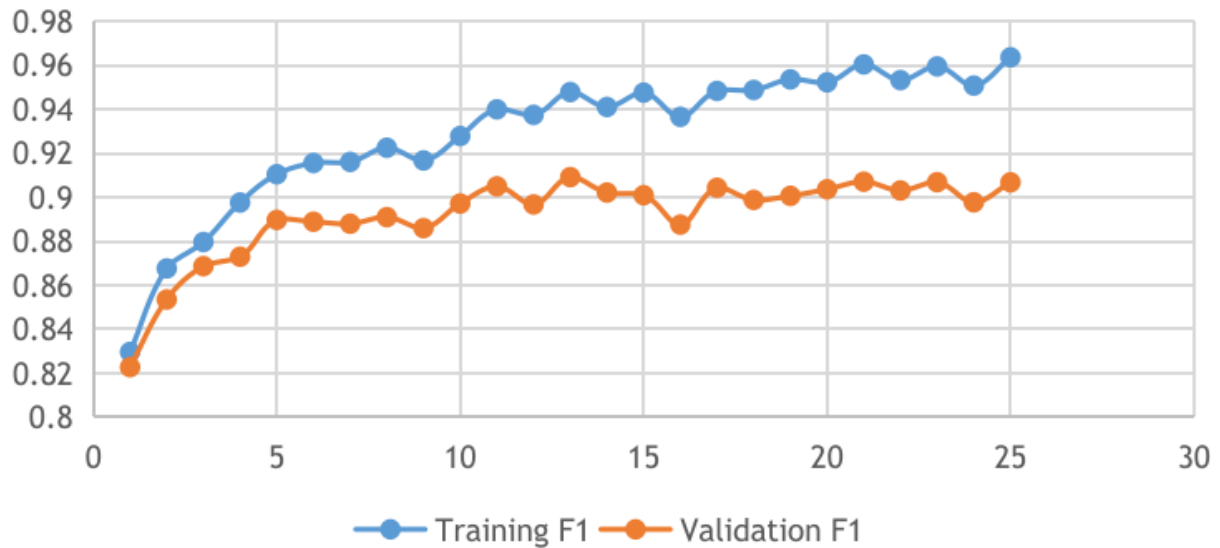# Model : Lenet

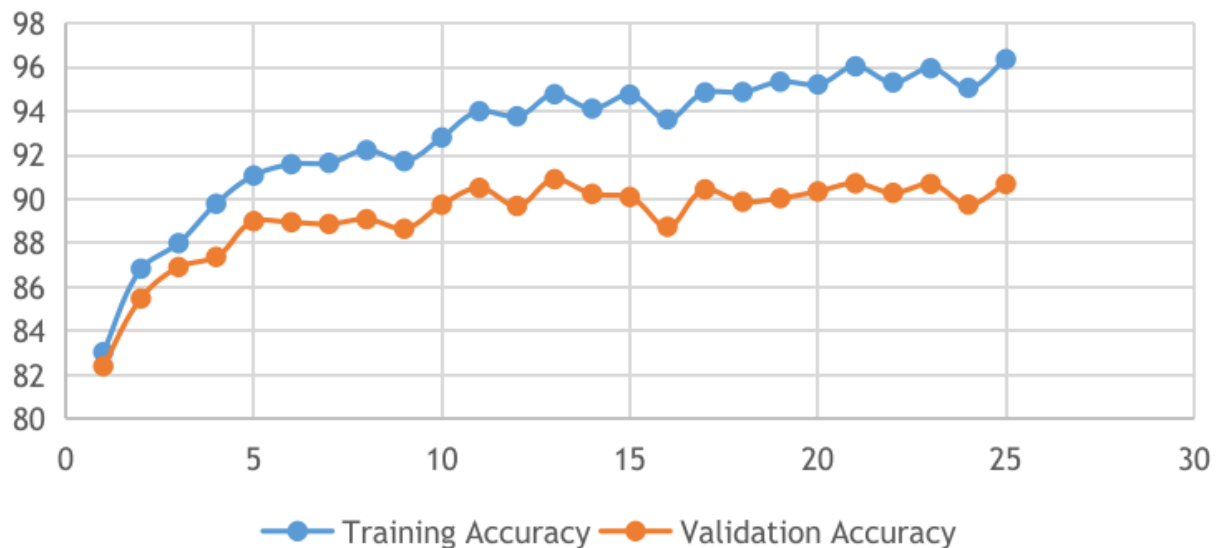## Learning Rate : 0.001

Epoch	Training Loss	Validation Loss	Training Accuracy	Validation Accuracy	Training F1	Validation F1
1	0.513887846	0.542916303	83.04427545	82.40757439	0.829672655	0.822755918
2	0.390306741	0.434706515	86.83759656	85.48241659	0.867639821	0.8535211
3	0.35191732	0.406430948	88.00084162	86.91614067	0.879646528	0.868688897
4	0.303262843	0.381777593	89.79229914	87.37601443	0.89761119	0.8729652
5	0.264945786	0.336247455	91.07577625	88.99909829	0.910477409	0.889700586
6	0.251066584	0.334376473	91.59277405	88.95401262	0.91559725	0.888881329
7	0.244623194	0.34103892	91.64988428	88.87285843	0.916082787	0.887971494
8	0.227212756	0.33983258	92.23300971	89.08926961	0.922536355	0.890968348
9	0.233677849	0.349615748	91.72803511	88.65644725	0.916737496	0.885963619
10	0.206872723	0.328192139	92.80711774	89.74752029	0.927841576	0.897152607
11	0.176036798	0.304324354	94.00342661	90.51397656	0.939983989	0.904973358
12	0.18234385	0.314569407	93.76897412	89.69341749	0.937465446	0.896725371
13	0.15497779	0.285662187	94.77591752	90.91073039	0.947823921	0.909171241
14	0.171999105	0.316169805	94.12065286	90.24346258	0.941053248	0.902150511
15	0.153330577	0.313440299	94.75487691	90.09918846	0.94756887	0.900947557
16	0.180219875	0.346817152	93.63070727	88.74661858	0.936569914	0.88757441
17	0.147597213	0.31551659	94.85406835	90.45085663	0.948345188	0.904329727
18	0.151848501	0.325470099	94.87510896	89.88277728	0.94878808	0.898804999
19	0.133725771	0.315808975	95.34401395	90.04508566	0.953598033	0.90064041
19	0.133725771	0.315808975	95.34401395	90.04508566	0.953598033	0.90064041
20	0.133761226	0.319703923	95.2207761	90.35166817	0.952258299	0.903636886
21	0.118672275	0.296279408	96.04436563	90.7213706	0.960411766	0.90708081
22	0.138425045	0.326962083	95.31095013	90.28854824	0.953271096	0.903083015
23	0.120101844	0.297925836	95.95419159	90.69431921	0.959486616	0.906846164
24	0.141112759	0.349264795	95.06447444	89.75653742	0.950777802	0.897715426
25	0.106801091	0.308531348	96.36899215	90.69431921	0.963655002	0.906793925

Traning F1 vs Validation F1, Learning Rate 0.001

Training F1 — Validation F1

Training Accuracy Vs Validation Accuracy Learning Rate 0.001

Training Accuracy — Validation Accuracy

Training Loss Vs Validation Loss
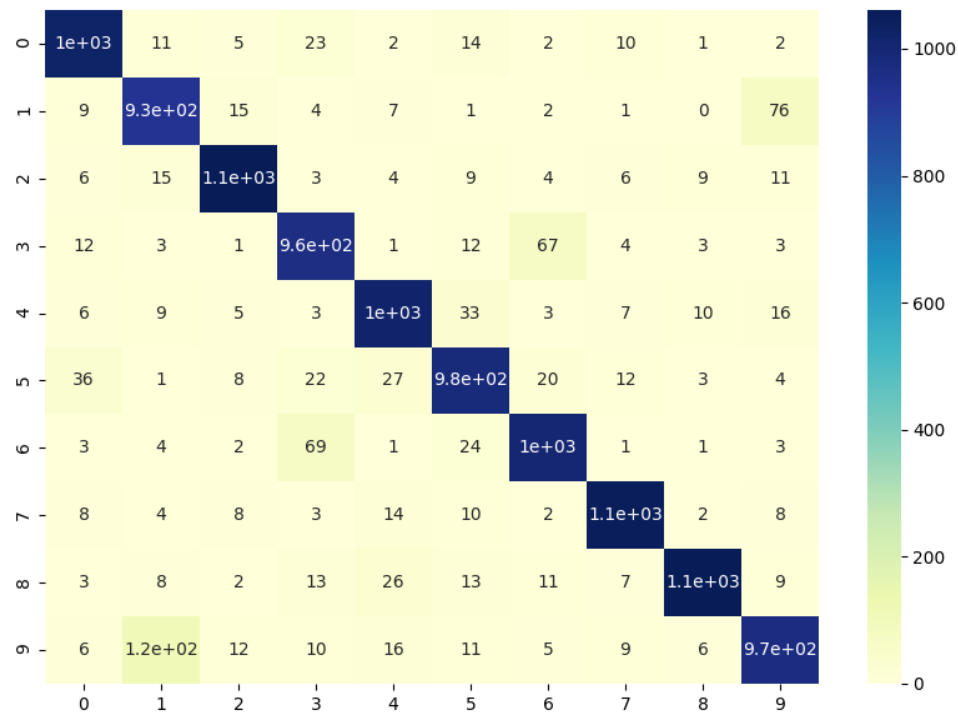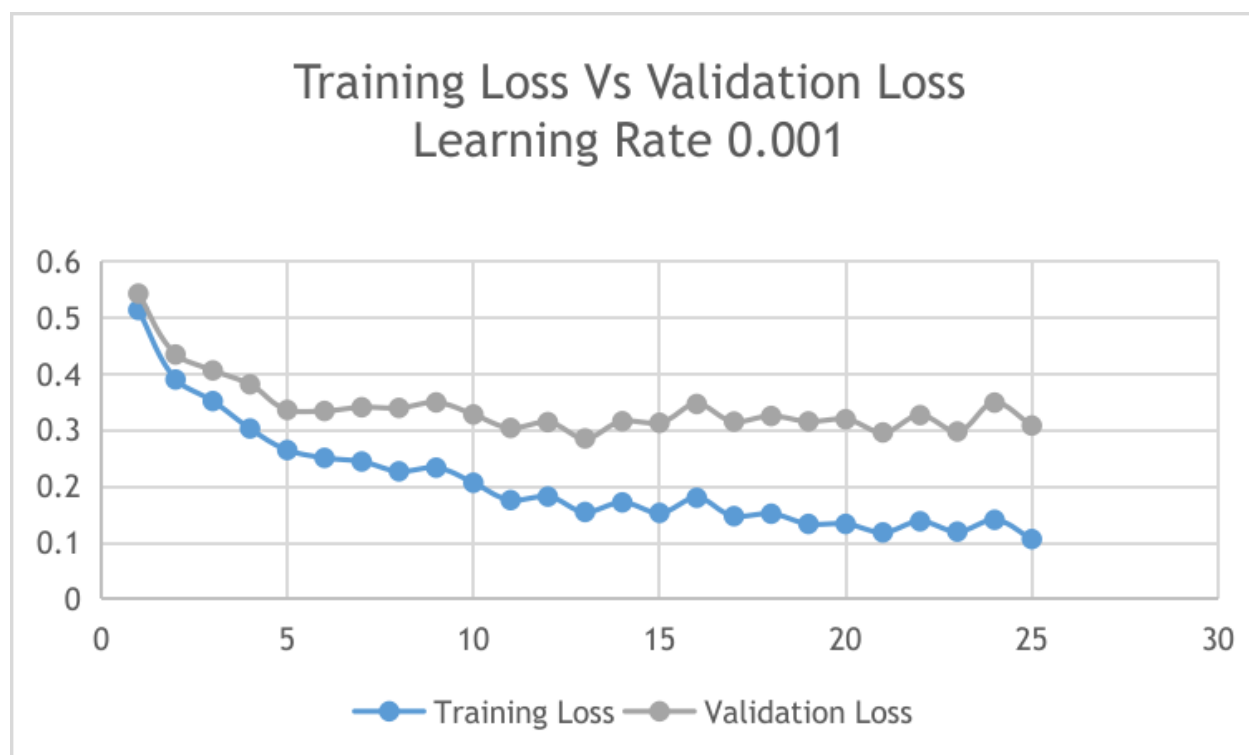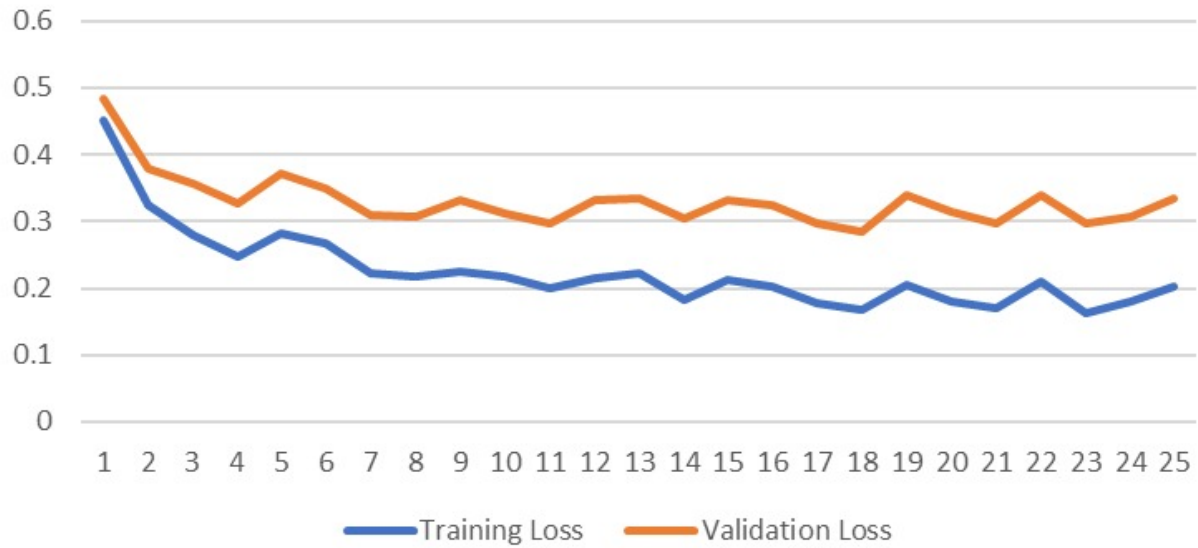Learning Rate 0.001
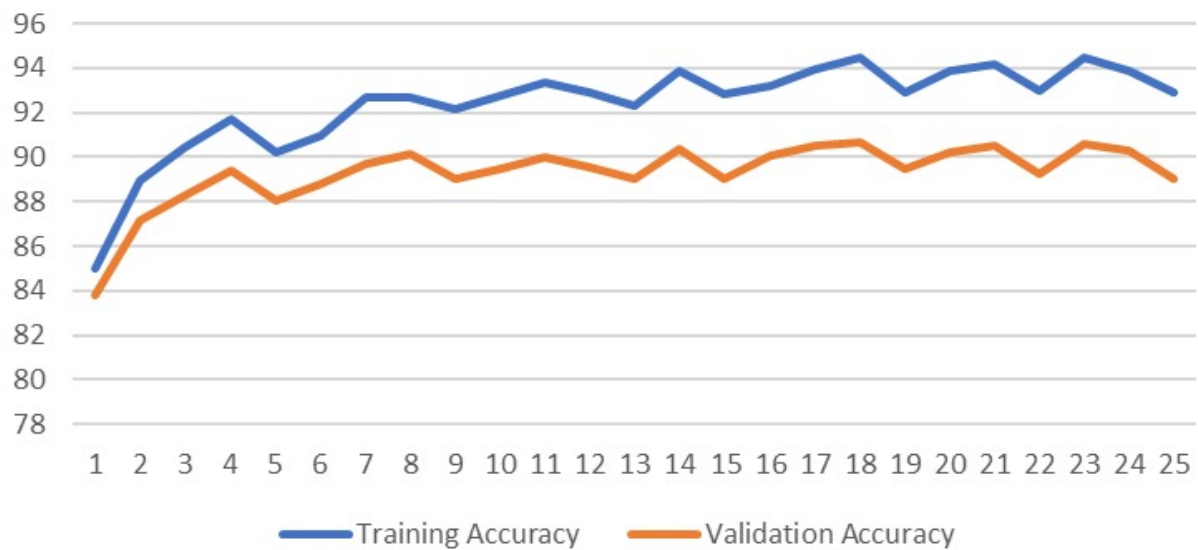

Fig : Confusion Matrix For Learning Rate 0.001

Learning Rate : 0.003

Epoch	Training Loss	Validation Loss	Training Accuracy	Validation Accuracy	Training F1	Validation F1
1	0.45159511	0.484613218	85.00405783	83.77817854	0.851124528	0.839051513
2	0.323487416	0.378215724	88.9506748	87.15960325	0.889574961	0.871695957
3	0.279091495	0.356164369	90.459587	88.26871055	0.904012346	0.882019613
4	0.247277857	0.327008433	91.73104091	89.36880072	0.917141621	0.893421555
5	0.281969165	0.372126397	90.22513451	88.0342651	0.903465147	0.881758884
6	0.266359397	0.348818679	90.98259641	88.8097385	0.909621135	0.888127972
7	0.223261345	0.310125901	92.69890889	89.67538323	0.926938993	0.896673918
8	0.21816255	0.30749949	92.67185668	90.13525699	0.926334899	0.900849889
9	0.224284457	0.331934724	92.13081247	89.02614968	0.92150294	0.890278027
10	0.216496143	0.313224886	92.74399591	89.47700631	0.927149495	0.894291988
11	0.200924034	0.297591098	93.36619676	89.96393147	0.933667307	0.899635522
12	0.213826684	0.331662475	92.87324536	89.56717764	0.928874333	0.895955116
13	0.222755512	0.334922817	92.33220115	89.04418395	0.923663697	0.89085607
14	0.183400381	0.303415429	93.84411915	90.39675383	0.938505538	0.904035576
15	0.212920704	0.332951317	92.80110613	89.02614968	0.928357304	0.890710425
16	0.202316434	0.323582045	93.2098951	90.03606853	0.93197574	0.900143624
17	0.178150168	0.296980612	93.98839761	90.50495942	0.939937939	0.905228034
18	0.167193278	0.284143735	94.43926779	90.64021641	0.944509621	0.906762531
19	0.204971942	0.339963904	92.91532658	89.48602344	0.92968203	0.895732704
20	0.180418145	0.313392596	93.87718296	90.22542831	0.938974693	0.902682154
21	0.171319788	0.298105829	94.2108269	90.52299369	0.94200328	0.905072145
22	0.210793352	0.338565548	93.00850642	89.2245266	0.929850574	0.891827805
23	0.163559967	0.296578193	94.50539541	90.61316501	0.94507226	0.906199803
24	0.179539181	0.30747092	93.89822357	90.27051398	0.938753224	0.902302772
25	0.202370755	0.334934883	92.94237879	89.04418395	0.929596276	0.890822805

Training Loss vs Validation Loss
Learning Rate: 0.003

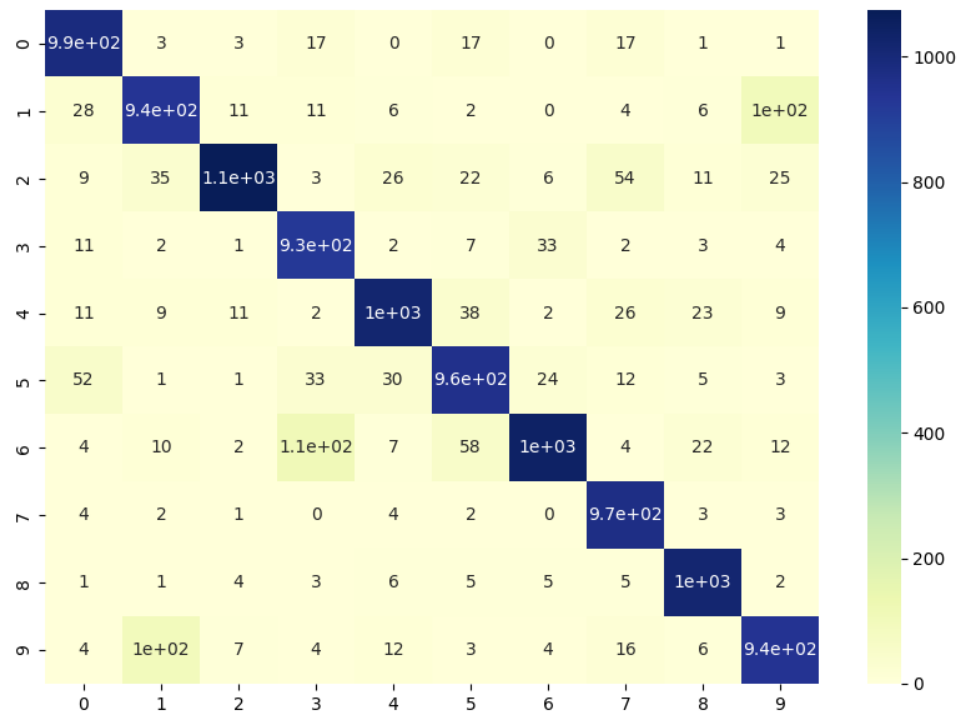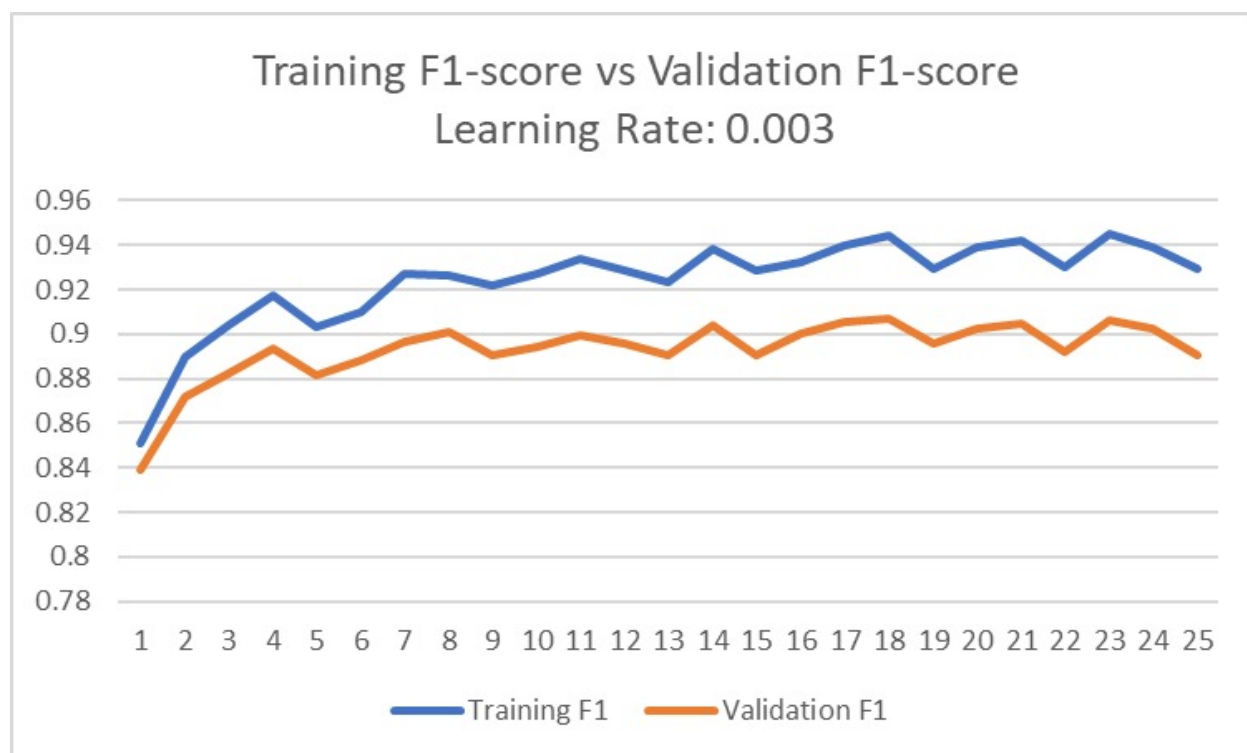Training Accuracy vs Validation Accuracy
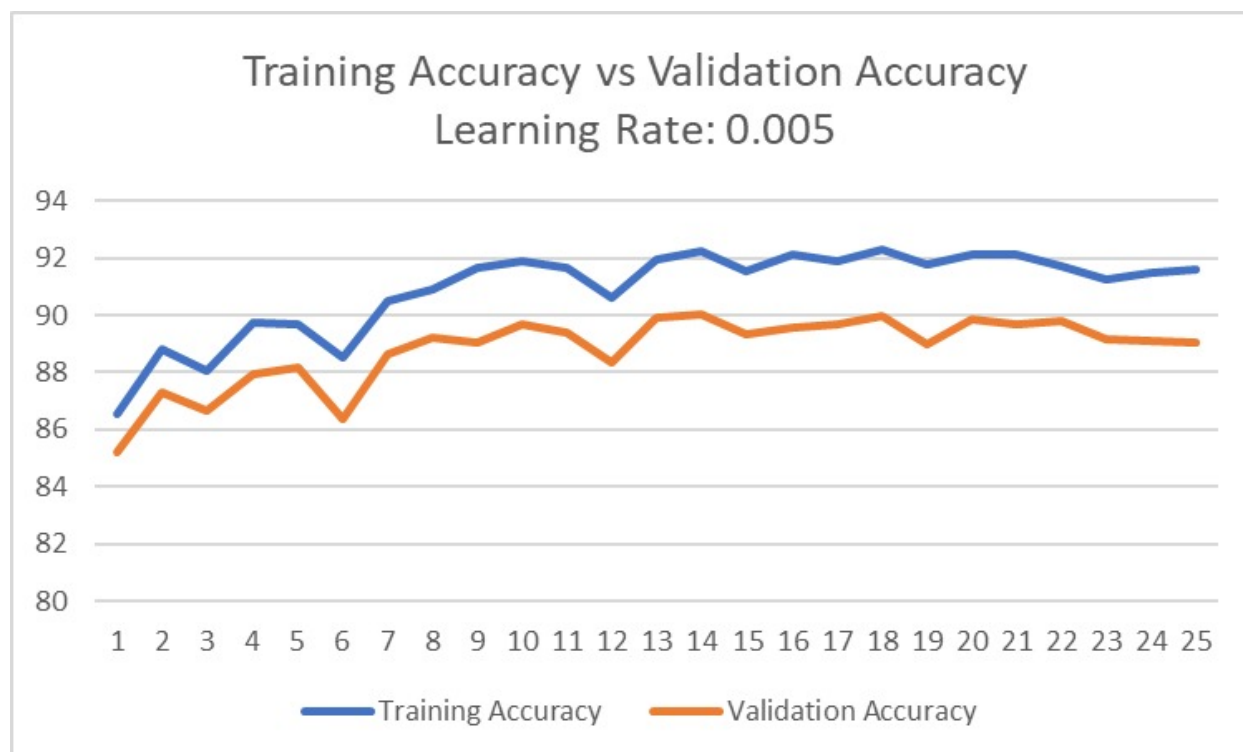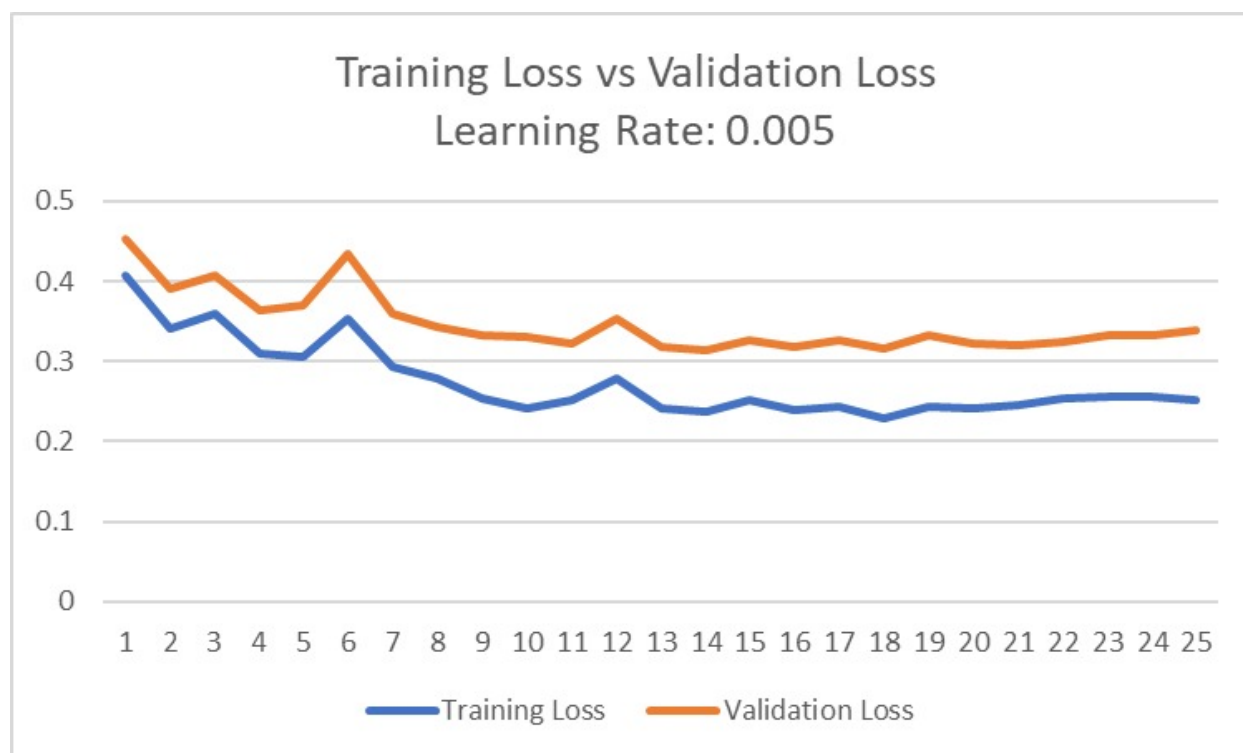Learning Rate: 0.003

Training F1-score vs Validation F1-score
Learning Rate: 0.003

Fig : Confusion Matrix For Learning Rate 0.003

Learning Rate : 0.005

Epoch	Training Loss	Validation Loss	Training Accuracy	Validation Accuracy	Training F1	Validation F1
1	0.40794898	0.452243307	86.57008025	85.22993688	0.864781609	0.85129655
2	0.341156888	0.39002971	88.80940215	87.32191163	0.887456659	0.872552438
3	0.360475379	0.40761755	88.06095765	86.63660956	0.880350778	0.865844353
4	0.310286231	0.36409034	89.72015991	87.94409378	0.897000629	0.87919415
5	0.305360822	0.3704621	89.68409029	88.15148783	0.897145635	0.881565834
6	0.353966427	0.433872545	88.49980462	86.37511271	0.884742854	0.863787571
7	0.293127718	0.35989156	90.49866242	88.65644725	0.904985531	0.886473742
8	0.277855261	0.342085254	90.92248039	89.21550947	0.908746643	0.891786416
9	0.252765573	0.333315768	91.64988428	89.01713255	0.916344478	0.889875966
10	0.241058286	0.329970461	91.91439478	89.68440036	0.919010121	0.896443606
11	0.252623885	0.322016616	91.65289008	89.40486925	0.916544706	0.894116496
12	0.278934067	0.35386103	90.58583065	88.36789901	0.905209877	0.882736908
13	0.242029189	0.317553443	91.92942379	89.93688007	0.919183064	0.899009208
14	0.237323158	0.314570245	92.2149749	90.01803427	0.922026045	0.899878855
15	0.251970193	0.326886072	91.53566383	89.32371506	0.915139849	0.892843176
16	0.239390413	0.318899538	92.11277766	89.5852119	0.92114238	0.895782403
17	0.243621912	0.32601153	91.91439478	89.67538323	0.918962044	0.896385183
18	0.229254765	0.316315445	92.26607352	89.95491434	0.922789972	0.899627427
19	0.243894218	0.331761676	91.78213953	89.00811542	0.917436034	0.889401006
20	0.240446634	0.323167681	92.12780667	89.84670875	0.920972368	0.898032555
21	0.24590973	0.319345723	92.09173705	89.65734896	0.920831194	0.896382645
22	0.254109033	0.323579605	91.69196549	89.81064022	0.916799569	0.89792124
23	0.256813929	0.332754686	91.23808951	89.14337241	0.911942873	0.890691707
24	0.255989016	0.332759969	91.4635246	89.11632101	0.914513214	0.890885038
25	0.252544048	0.338217561	91.61080886	89.04418395	0.916254469	0.890519715

Training Loss vs Validation Loss
Learning Rate: 0.005

Training Loss — Validation Loss

Training Accuracy vs Validation Accuracy
Learning Rate: 0.005

Training Accuracy — Validation Accuracy

Training F1-score vs Validation F1-score
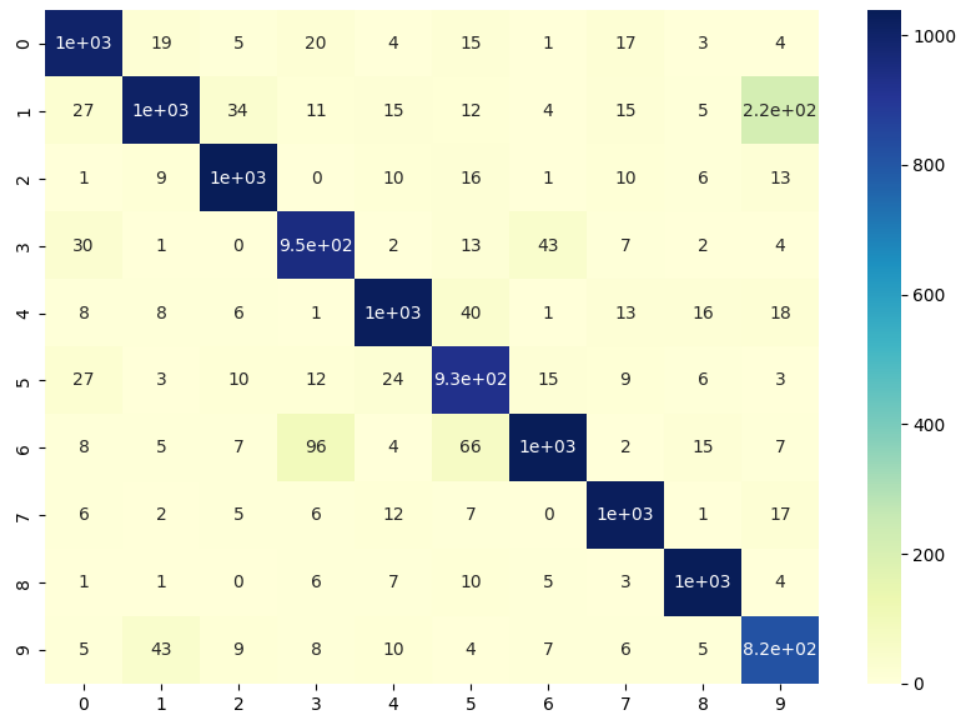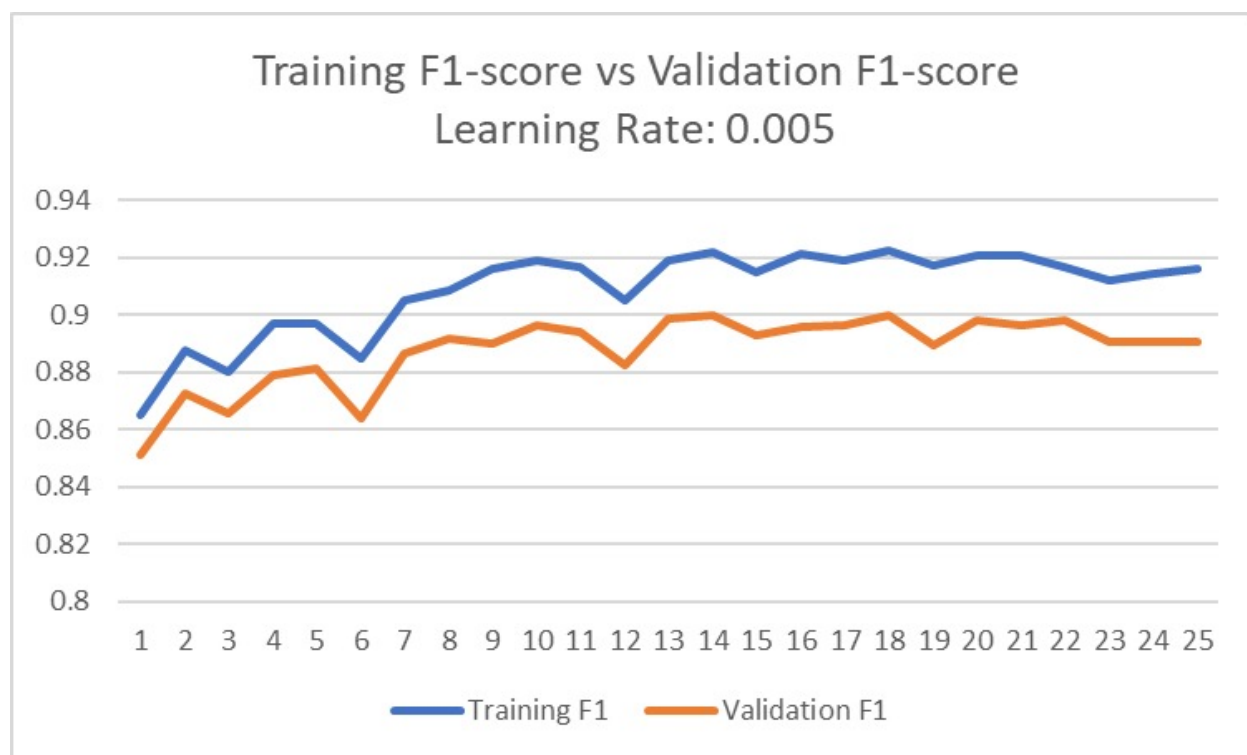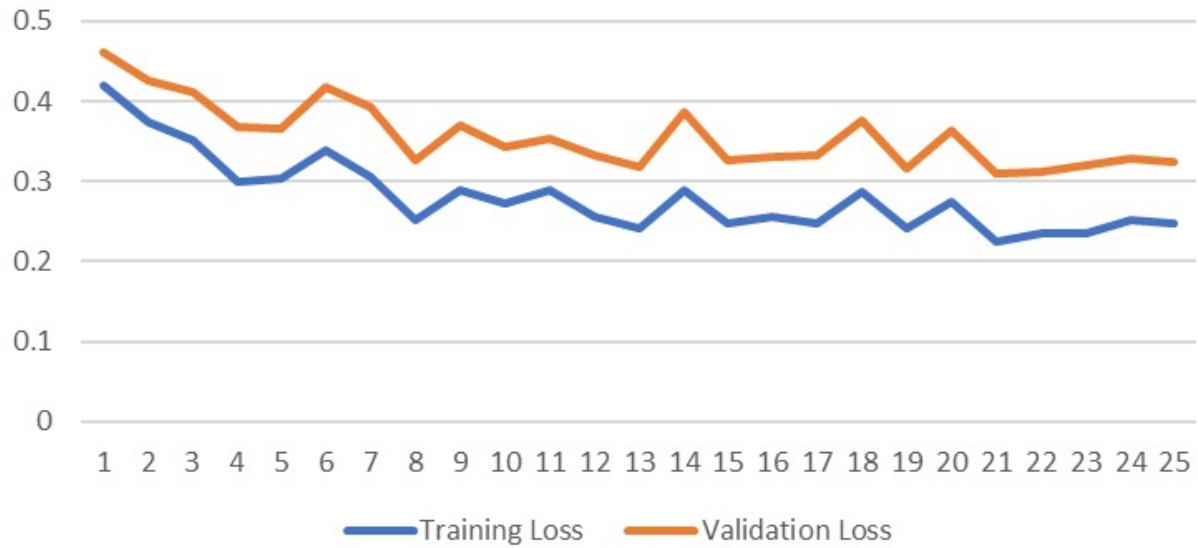Learning Rate: 0.005

Fig : Confusion Matrix For Learning Rate 0.005

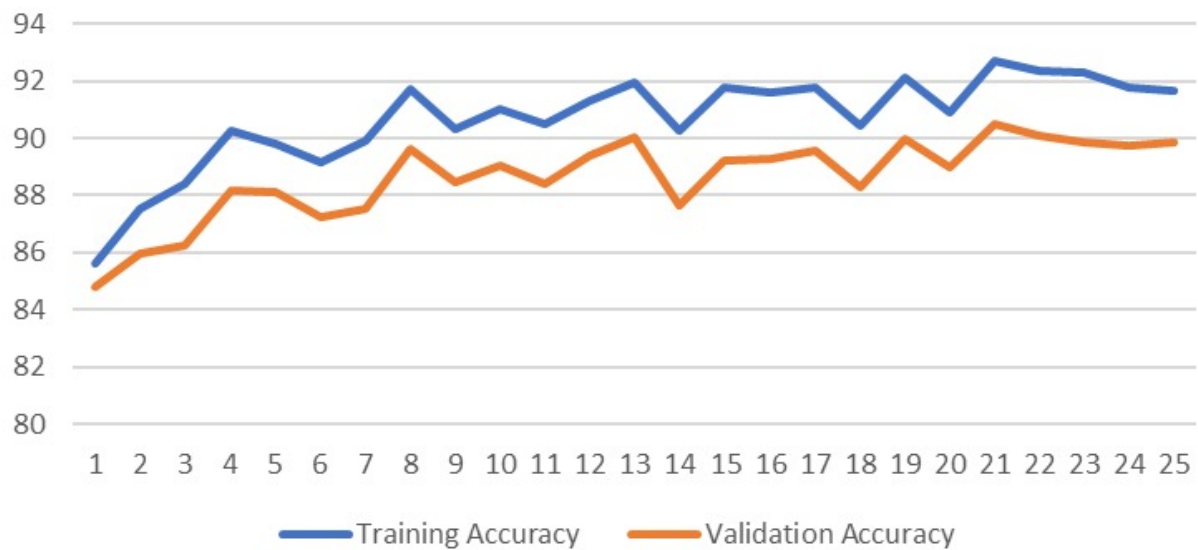# Learning Rate : 0.006

Epoch	Training Loss	Validation Loss	Training Accuracy	Validation Accuracy	Training F1	Validation F1
1	0.419724594	0.461629108	85.60521807	84.78809739	0.856118681	0.848139547
2	0.373360822	0.425062287	87.54696564	85.96032462	0.875809413	0.859662014
3	0.351376167	0.410722041	88.40361898	86.23985573	0.883069869	0.861504885
4	0.299191959	0.368479219	90.24316932	88.16050496	0.902474456	0.881724945
5	0.304333872	0.366128667	89.77426433	88.1154193	0.896945078	0.880279382
6	0.339429846	0.417506432	89.14605188	87.2587917	0.890956293	0.872009822
7	0.30565634	0.391911166	89.88848478	87.52028855	0.899226834	0.875683773
8	0.251213144	0.325311656	91.73705251	89.63029757	0.917194953	0.896154073
9	0.288066347	0.37089361	90.31831435	88.4490532	0.902507405	0.883647937
10	0.273115471	0.342233442	91.03068923	89.02614968	0.910184659	0.890014295
11	0.288001114	0.352506011	90.51970303	88.4220018	0.90516923	0.88398934
12	0.256132057	0.332420186	91.30121134	89.41388638	0.913258429	0.894404703
13	0.241963937	0.318620827	91.94445279	90.00901713	0.919695882	0.900365738
14	0.288378715	0.386680957	90.23415191	87.66456267	0.901824122	0.875705139
15	0.247674161	0.326984731	91.76109892	89.23354373	0.917763122	0.892495143
16	0.25555997	0.330182292	91.61080886	89.29666366	0.915757376	0.892458393
17	0.247527278	0.333104152	91.75508732	89.57619477	0.917597036	0.895835385
18	0.285934903	0.375988474	90.42652319	88.27772768	0.905158414	0.883705294
19	0.240679081	0.316550022	92.09774865	89.98196573	0.921004609	0.899807792
20	0.274585476	0.364465898	90.87438757	88.96302976	0.908518382	0.889488845
21	0.225200452	0.30887993	92.69890889	90.48692516	0.926996866	0.904868611
22	0.234108169	0.311051015	92.34121855	90.09918846	0.923537914	0.901063523
23	0.234761581	0.320405245	92.30514894	89.85572588	0.922902861	0.898374565
24	0.251337246	0.328021185	91.77312213	89.76555455	0.917875771	0.897653219
25	0.247581064	0.324195296	91.62884367	89.85572588	0.916146597	0.898386213

Training Loss vs Validation Loss
Learning Rate: 0.006
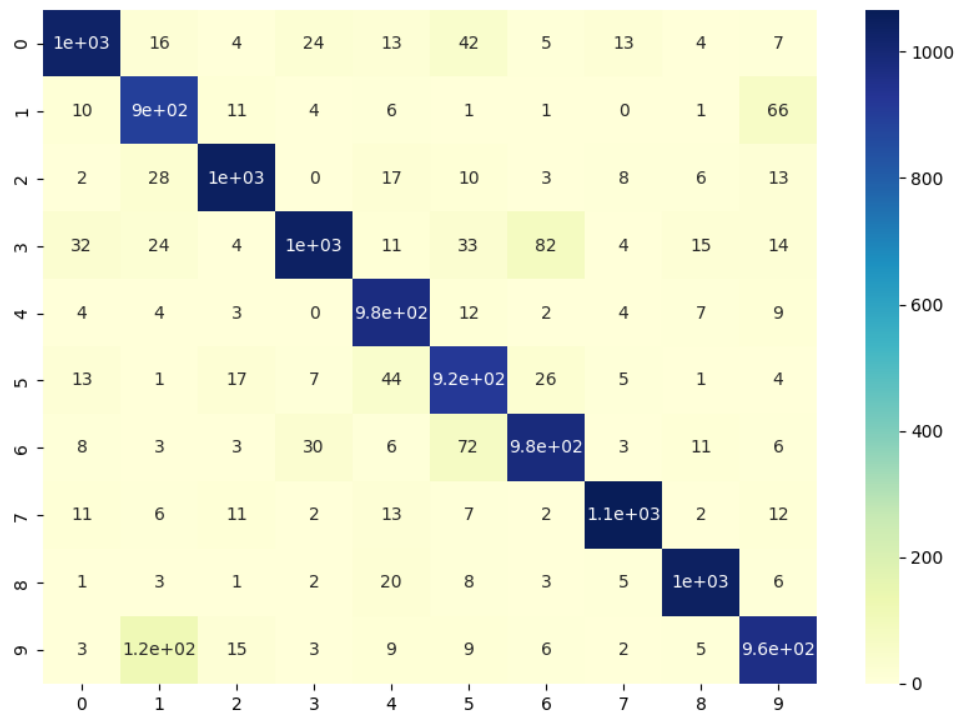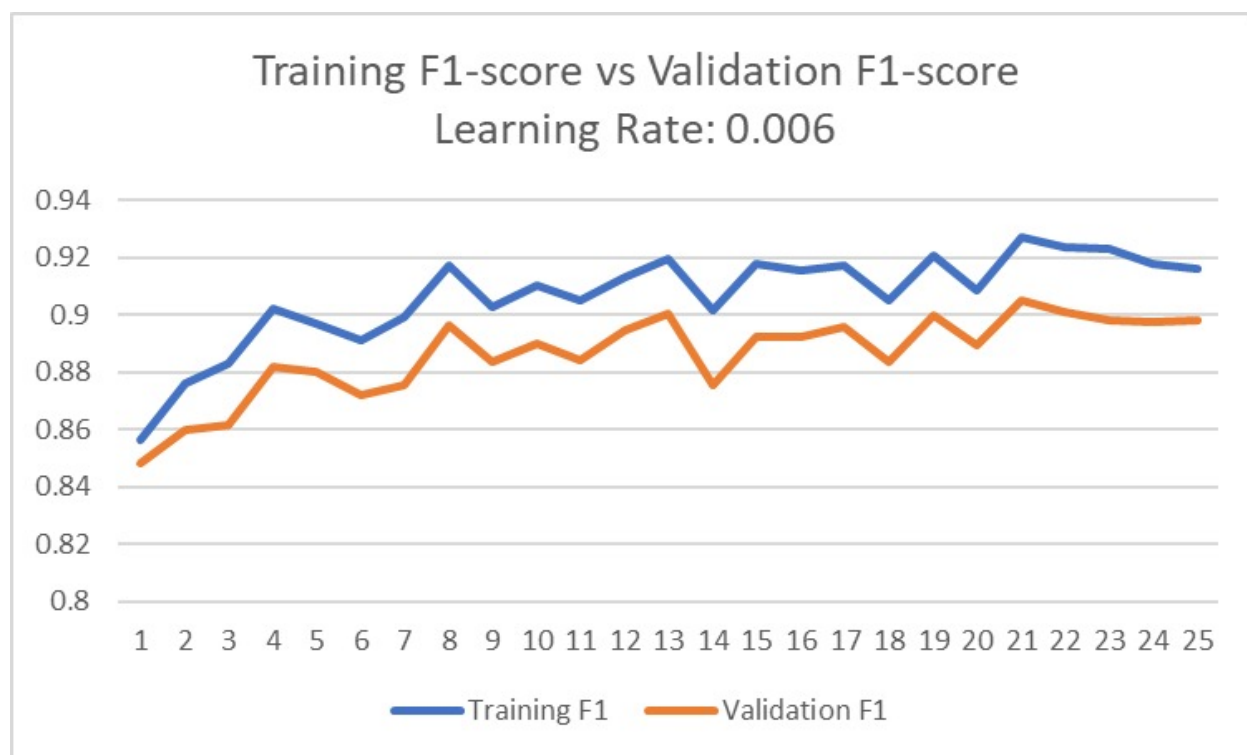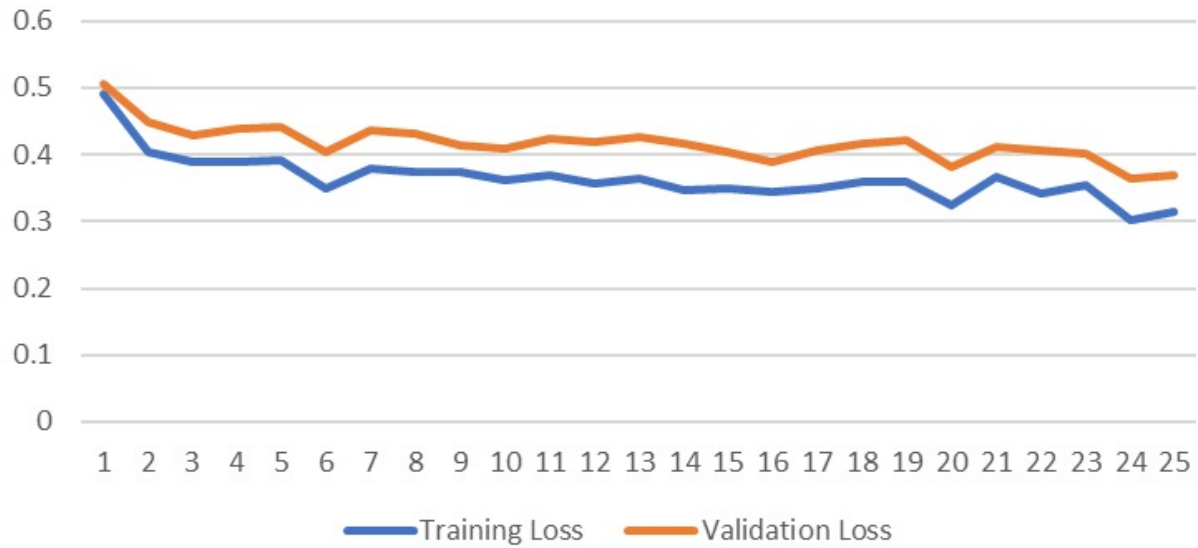

Training Accuracy vs Validation Accuracy
Learning Rate: 0.006

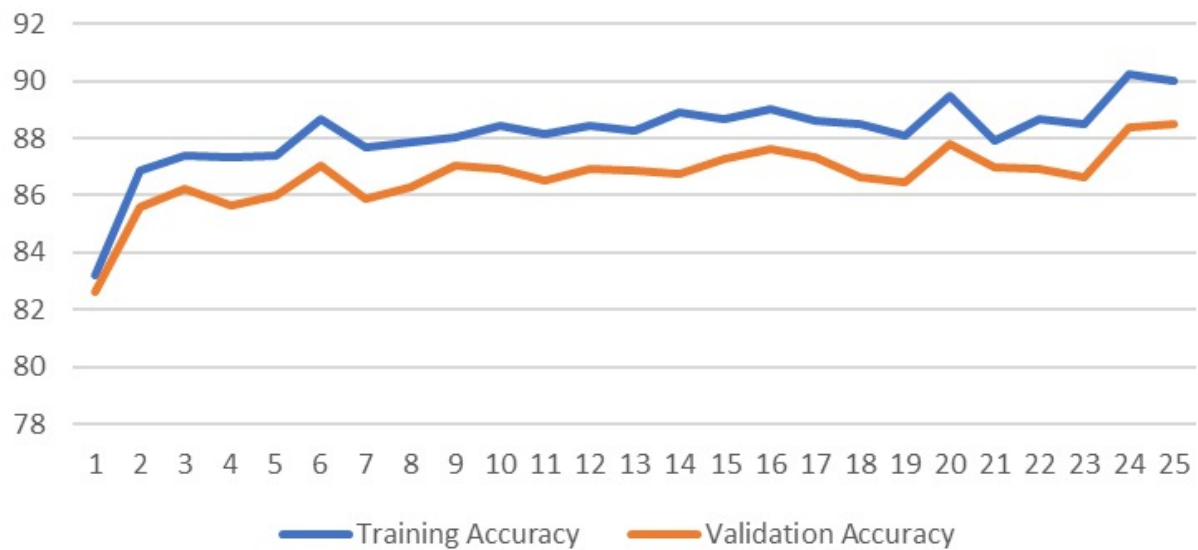Fig : Confusion Matrix For Learning Rate 0.006

Learning Rate : 0.01

Epoch	Training Loss	Validation Loss	Training Accuracy	Validation Accuracy	Training F1	Validation F1
1	0.491089911	0.506839119	83.19757131	82.61496844	0.829646999	0.823710229
2	0.404355844	0.448072838	86.85563137	85.57258792	0.868085156	0.854867441
3	0.388475443	0.428750999	87.37864078	86.23083859	0.872857218	0.861279719
4	0.388842376	0.439863686	87.34858276	85.64472498	0.872751399	0.855579995
5	0.391842872	0.440965194	87.38765818	85.97835888	0.873836068	0.859472946
6	0.348915889	0.404855224	88.64107728	87.02434626	0.886033238	0.869806874
7	0.379869774	0.435813441	87.6852325	85.86113616	0.87709024	0.858995329
8	0.373890658	0.43082373	87.83852836	86.31199279	0.878536096	0.863197714
9	0.37324969	0.412766628	88.01887643	87.02434626	0.880064071	0.870052854
10	0.361595182	0.408553967	88.40963059	86.8981064	0.884116723	0.868816072
11	0.369493029	0.424972197	88.13610268	86.51938683	0.881564197	0.865314126
12	0.357649871	0.418222588	88.42165379	86.9251578	0.883496765	0.868450236
13	0.363072031	0.425235222	88.25633473	86.86203787	0.882585351	0.86866482
14	0.347237456	0.416028724	88.90558778	86.74481515	0.888534427	0.866692594
15	0.348263349	0.404188324	88.68015269	87.26780884	0.886808085	0.872799108
16	0.343915757	0.389865674	88.99876762	87.6465284	0.889933965	0.876452336
17	0.348731547	0.40534584	88.58997866	87.35798016	0.88574727	0.873567418
18	0.358866258	0.416961401	88.49379302	86.64562669	0.88480489	0.866156905
19	0.359266489	0.421841482	88.11205627	86.43823264	0.880698307	0.863975784
20	0.325249664	0.381894877	89.47368421	87.81785392	0.894681328	0.877845347
21	0.366168284	0.411974738	87.88662118	86.99729486	0.878716514	0.869925937
22	0.34283602	0.406191729	88.6951817	86.8981064	0.886429237	0.868067814
23	0.355443757	0.401277197	88.46674081	86.65464382	0.883669548	0.865151653
24	0.302114204	0.363142091	90.23114611	88.40396754	0.902363999	0.884084623
25	0.314238887	0.368753477	90.00571102	88.49413886	0.899802756	0.88459155

Training Loss vs Validation Loss
Learning Rate: 0.01

— Training Loss — Validation Loss

Training Accuracy vs Validation Accuracy
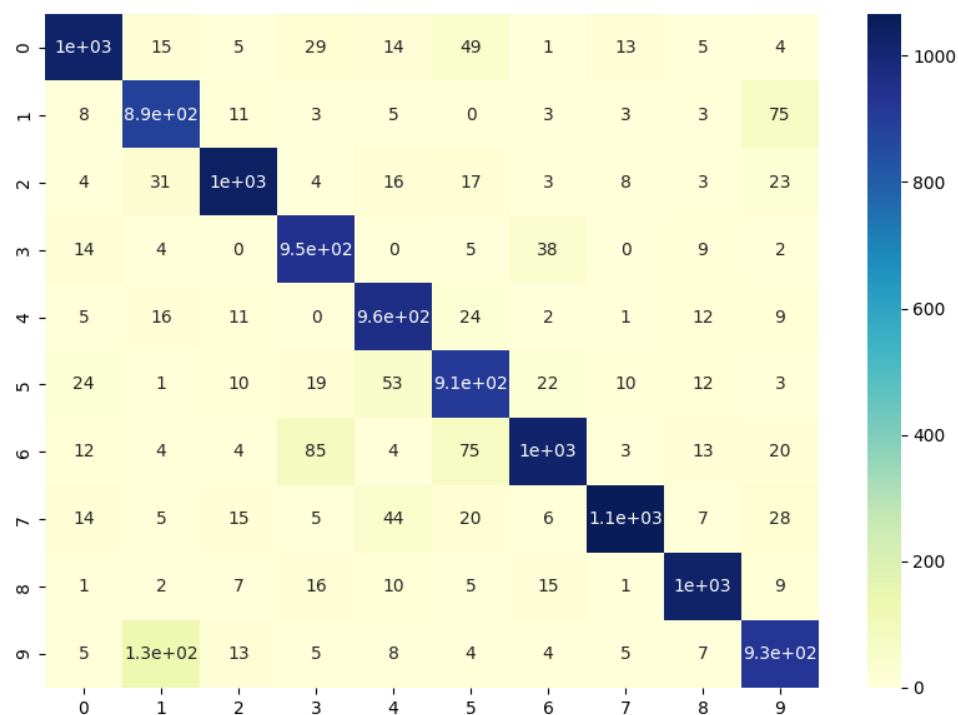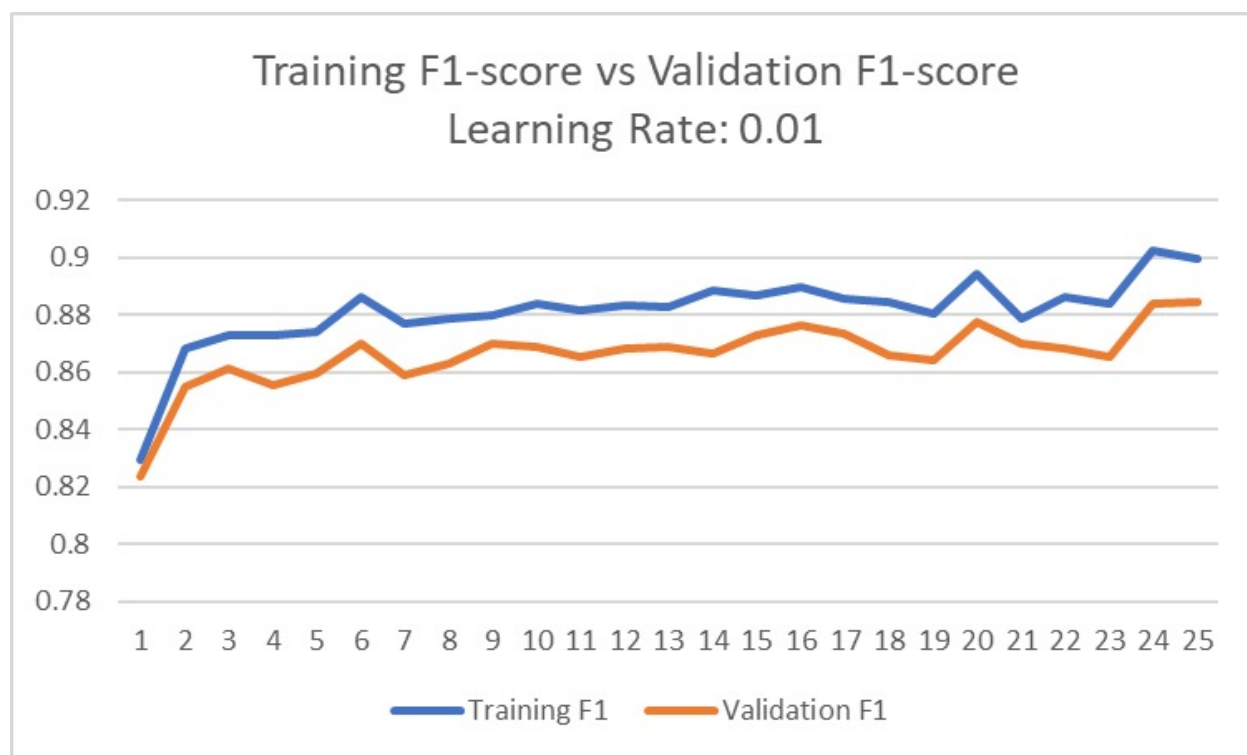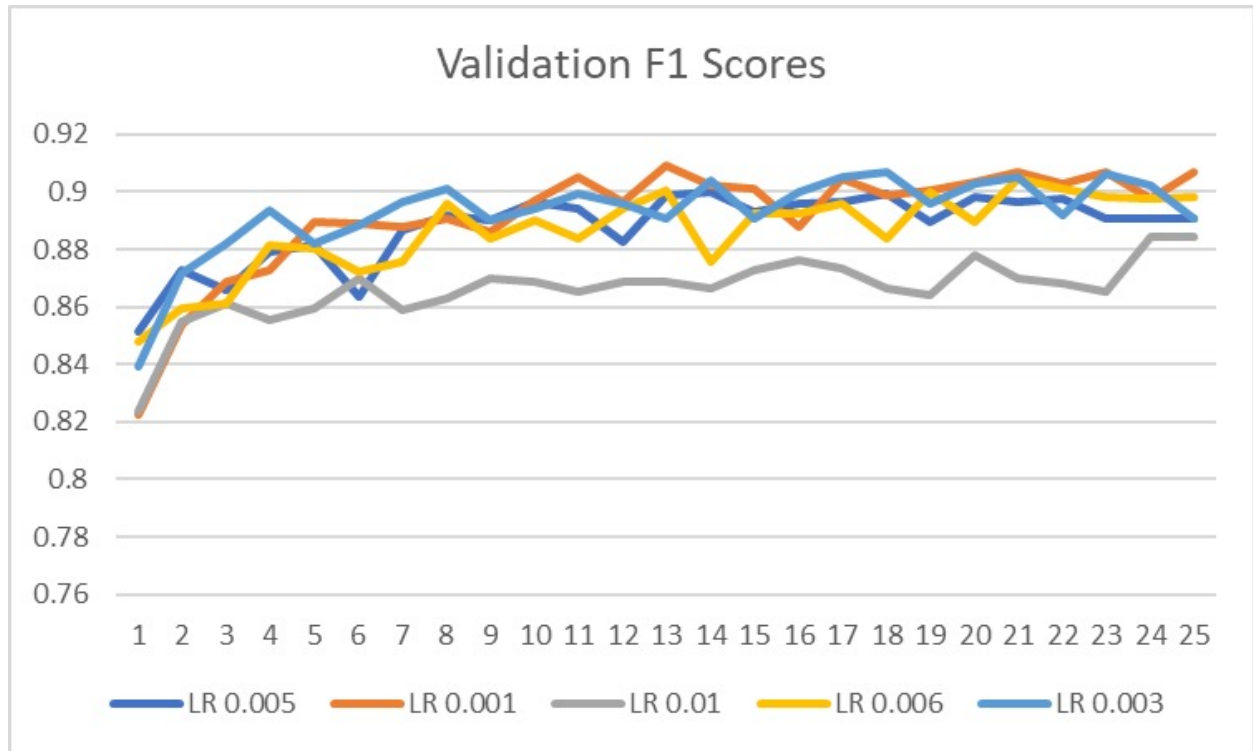**Learning Rate: 0.01**

— Training Accuracy — Validation Accuracy

Fig : Confusion Matrix For Learning Rate 0.01

Comparison Between F1 Scores
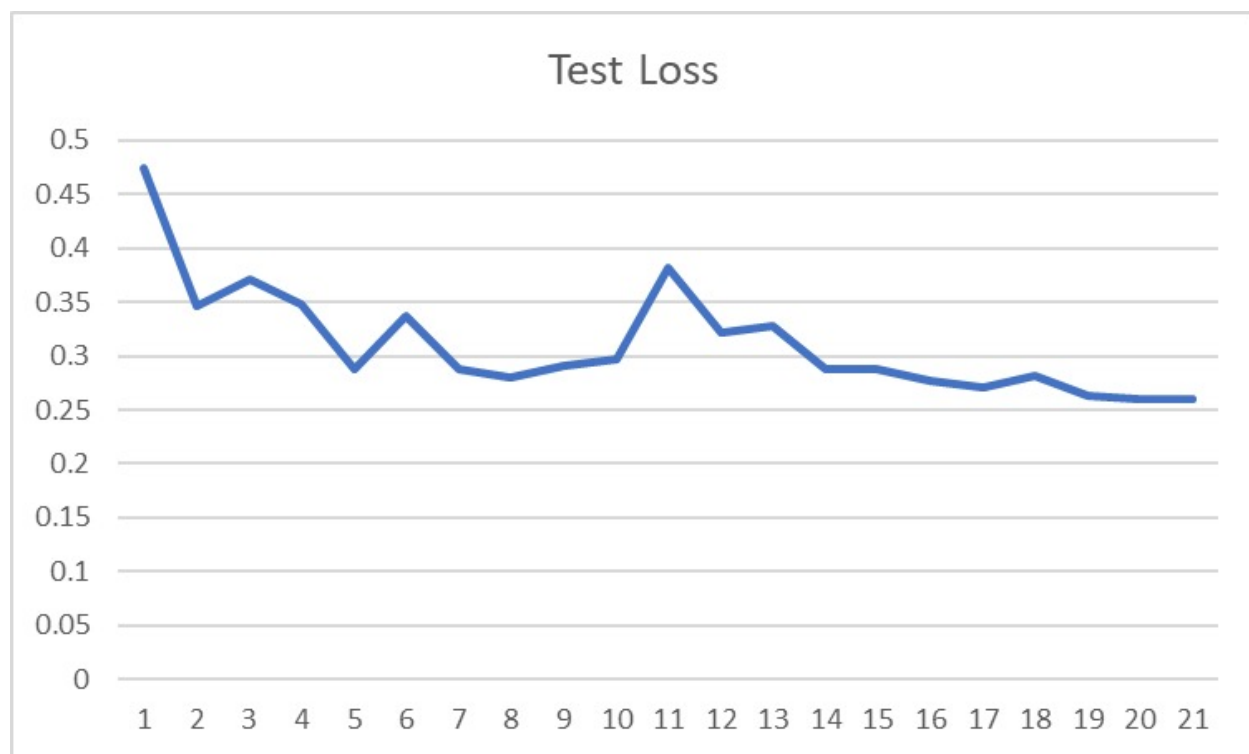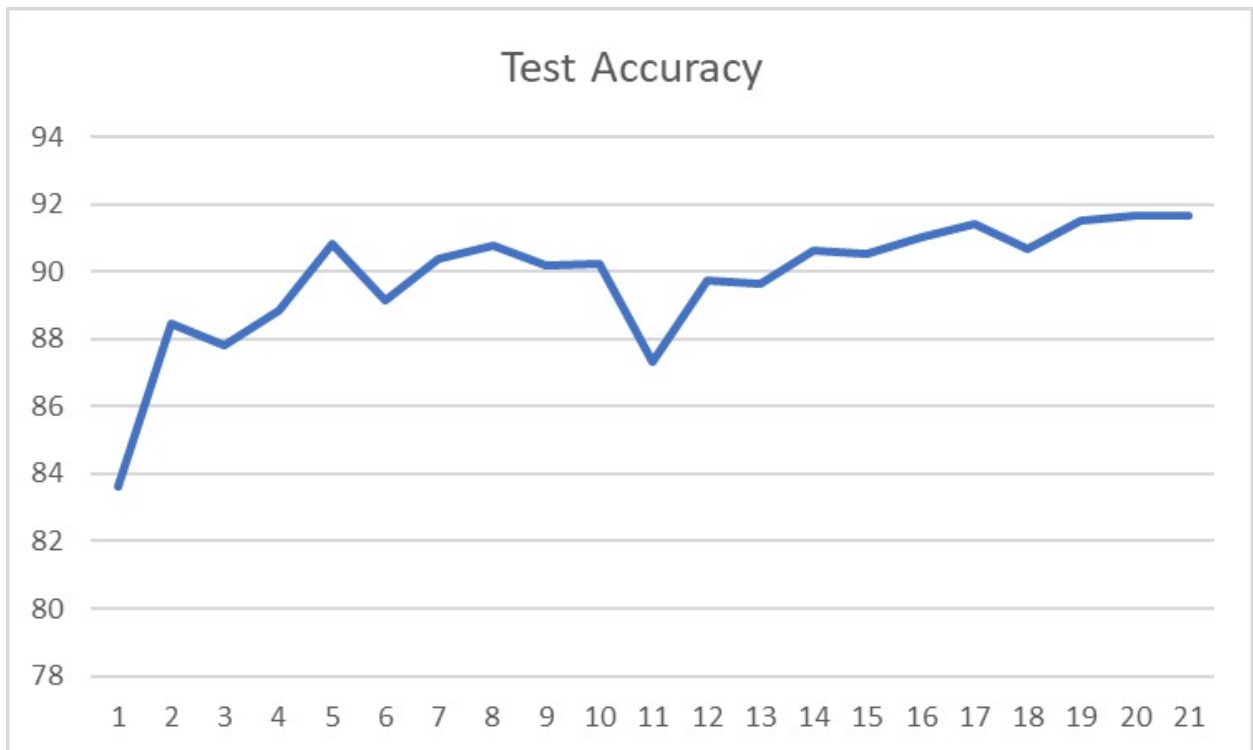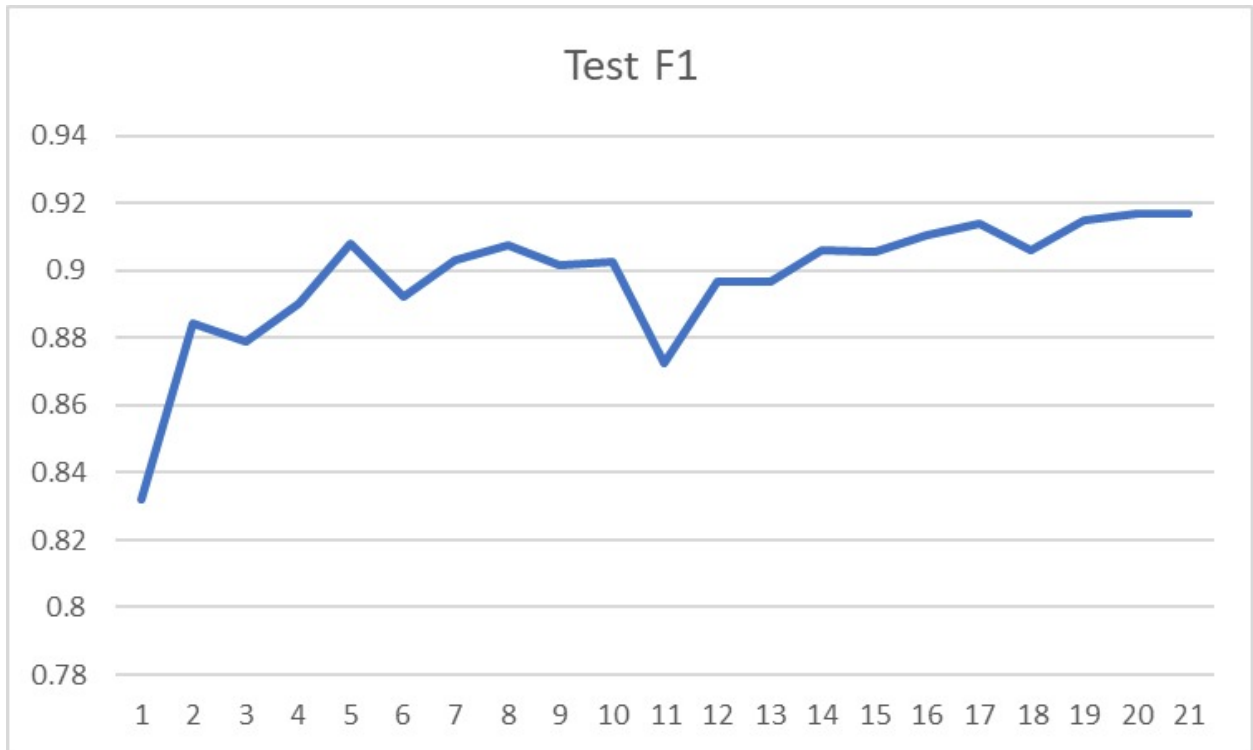

Validation F1 Scores

Legend: LR 0.005, LR 0.001, LR 0.01, LR 0.006, LR 0.003

Best F1 Score from : 0.001

Epoch	Test Loss	Test Accuracy	Test F1
1	0.632140875	78.11697836	0.781014351
2	0.421487208	85.98276494	0.858499395
3	0.336886131	88.95306197	0.889472064
4	0.330394936	89.41144114	0.893895156
5	0.315134167	89.6589659	0.896477211
6	0.278409832	91.03410341	0.910576523
7	0.283940109	90.74074074	0.906994531
8	0.305100939	89.97066373	0.900032597

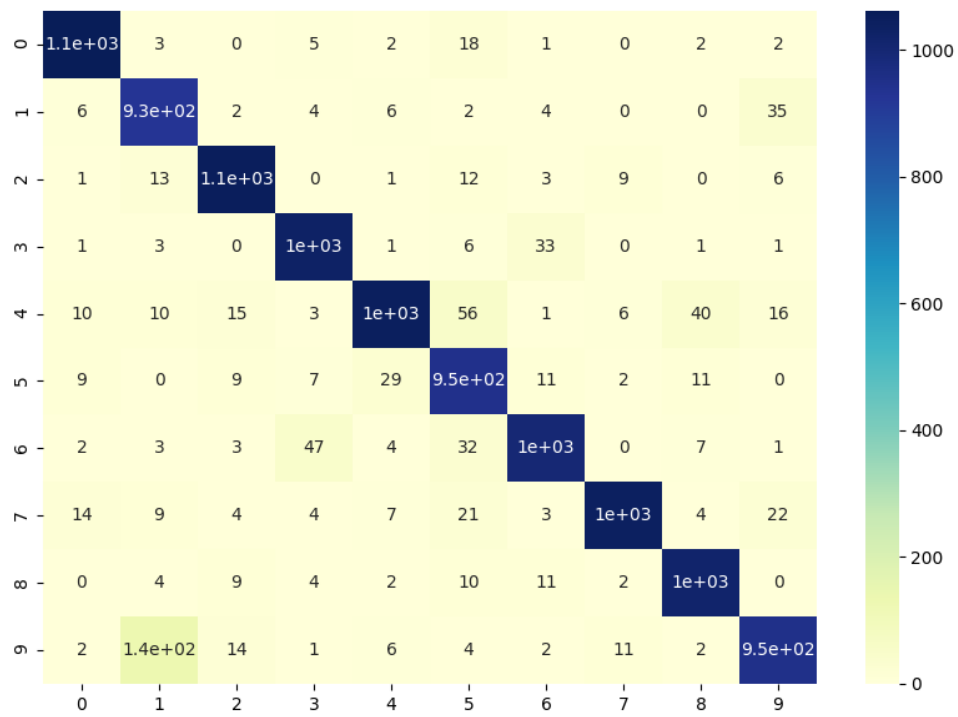|			
9	0.279033453	90.61239457	0.905727724
10	0.276943994	90.74074074	0.907475417
11	0.276034058	90.97909791	0.909700161
12	0.297249792	90.95159516	0.909172171
13	0.270649492	90.94242758	0.909689279
14	0.248347352	92.02420242	0.9203941
15	0.239920442	92.13421342	0.921334579
16	0.252701409	91.76751008	0.917634009
17	0.239499066	92.45507884	0.924400421
18	0.260289467	91.50165017	0.915499234
19	0.251800144	91.923359	0.918968653
20	0.24086809	92.44591126	0.924235749
21	0.24086809	92.44591126	0.924235749

Test Loss

Test F1

Test Accuracy

Fig : Confusion Matrix For Learning Rate 0.001