SYLLABUS

DD0401-Dual Degree B.Tech.-M.Tech. in Converging Technologies

2025-2029

Dy. Registrar
(Academic)
University of Rajasthan
JAIPUR

Name of University	**University of Rajasthan, Jaipur**
Name of Faculty	**Engineering and Technology**
Name of Discipline	**Converging Technologies**

First Semester

Year	Semester	S. No.	Course Code	Course Title	Subject Area	Credits	Contacts Hours/Week				TotalMarks	CA			EoSE		
							L	T	P	Total		Max. Marks	Min. Marks	MidtermTest Duration	Max. Marks	Min. Marks	Duration
1	I	1	CCT-51T-HSMC-101	Communication Skills	HSMC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
1	I	2	CCT-51T-BSC-101	Physics-I	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
1	I	3	CCT-51T-BSC-102	Chemistry-I	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
1	I	4	CCT-51T-BSC-103	Mathematics-I	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
1	I	5	CCT-51T-BSC-104	Genetics	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
1	I	6	CCT-51P-BSC-121	Physics Lab - I	BSC	**2**	0	0	4	**4**	50	10	4	2	40	16	4
1	I	7	CCT-51P-BSC-122	Chemistry Lab -I	BSC	**2**	0	0	4	**4**	50	10	4	2	40	16	4
1	I	8	CCT-51P-BSC-123	Life Sciences Lab	BSC	**2**	0	0	4	**4**	50	10	4	2	40	16	4
1	I	9	CCT-51T-ESC-101	Programming in C	ESC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
1	I	10	CCT-51T-ESC-102	Biochemistry	ESC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
1	I	11	CCT-51T-ESC-103	Basic Psychological Processes	ESC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
1	I	12	CCT-51P-ESC-121	Programming in C Lab	ESC	**2**	0	0	4	**4**	50	10	4	2	40	16	4
1	I	13	CCT-51F-MC-101	Anandam-I	MC	**0**	0	0	2	**2**	50				50	20	
						24	**16**	**0**	**18**	**34**	**600**						

Semester	Category	HSMC	BSC	ESC	PCC	PEC	OEC	LC	MC	Total
I	Credit	2	14	8	0	0	0	0	0	24

Second Semester

Year	Semester	S. No.	Course Code	Course Title	Subject Area	Credits	Contacts Hours/Week				TotalMarks	CA			EoSE		
							L	T	P	Total		Max. Marks	Min. Marks	MidtermTest Duration	Max. Marks	Min. Marks	Duration
1	II	1	CCT-52T-HSMC-102	Scientific Writing	HSMC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
1	II	2	CCT-52T-BSC-105	Physics-II	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
1	II	3	CCT-52T-BSC-106	Chemistry-II	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
1	II	4	CCT-52T-BSC-107	Mathematics-II	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
1	II	5	CCT-52T-BSC-108	Cell Biology	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
1	II	6	CCT-52P-BSC-124	Physics Lab - II	BSC	**2**	0	0	4	**4**	50	50	10	2	2	40	4
1	II	7	CCT-52P-BSC-125	Chemistry Lab - II	BSC	**2**	0	0	4	**4**	50	10	4	2	40	16	4
1	II	8	CCT-52P-BSC-126	Cell Biology Lab	BSC	**2**	0	0	4	**4**	50	10	4	2	40	16	4
1	II	9	CCT-52T-ESC-104	Semiconductor Electronics Devices and Applications	ESC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
1	II	10	CCT-52T-ESC-105	Object Oriented Programming	ESC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
1	II	11	CCT-52P-ESC-122	Semiconductor Electronics Lab	ESC	**2**	0	0	4	**4**	50	10	4	1	40	16	3
1	II	12	CCT-52P-ESC-123	C++ Programming Lab	ESC	**2**	0	0	4	**4**	50	10	4	2	40	16	4
1	II	13	CCT-52F-MC-102	Environmental Studies	MC	**0**	2	0	0	**2**	50				50	20	
						24	**16**	**0**	**20**	**36**	**600**						

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Semester	Category	HSMC	BSC	ESC	PCC	PEC	OEC	LC	MC	Total
II	Credit	2	14	8	0	0	0	0	0	24

Third Semester

Year	Semester	S. No.	Course Code	Course Title	Subject Area	Credits	Contacts Hours/Week				Total Marks	CA			EoSE		
							L	T	P	Total		Max. Marks	Min. Marks	MidtermTest Duration	Max. Marks	Min. Marks	Duration
2	III	1	CCT-63T-HSMC-201	Industrial Economics	HSMC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	III	2	CCT-63T-BSC-201	Quantum Physics	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	III	3	CCT-63T-BSC-202	Principles and Applications of Molecular Spectroscopy	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	III	4	CCT-63T-BSC-203	Advanced Mathematics	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	III	5	CCT-63T-BSC-204	Development Biology	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	III	6	CCT-63T-PCC-201	Solid State Physics	PCC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	III	8	CCT-63T-PCC-202	Molecular Biology	PCC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	III	9	CCT-63T-PCC-203	Cognitive Psychology	PCC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	III	7	CCT-63P-PCC-221	Material Science Lab	PCC	**2**	0	0	4	**4**	50	10	4	2	40	16	4
2	III	10	CCT-63P-PCC-222	Psychology Lab	PCC	**2**	0	0	4	**4**	50	10	4	2	40	16	4
2	III	11	CCT-63T-ESC-201	Programming in Java	ESC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	III	12	CCT-63P-ESC-221	Java Programming Lab	ESC	**2**	0	0	4	**4**	50	10	4	2	40	16	4
2	III	13	CCT-63F-MC-201	Anandam-II	MC	**0**	0	0	2	**2**	50				50	20	
						24	**18**	**0**	**12**	**32**							

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Semester	Category	HSMC	BSC	ESC	PCC	PEC	OEC	LC	MC	Total
III	Credit	2	8	4	10	0	0	0	0	24

Fourth Semester

Year	Semester	S. No.	Course Code	Course Title	Subject Area	Credits	Contacts Hours/Week				Total Marks	CA			EoSE		
							L	T	P	Total		Max. Marks	Min. Marks	MidtermTest Duration	Max. Marks	Min. Marks	Duration
2	IV	1	CCT-64T-HSMC-202	Entrepreneurship	HSMC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	IV	2	CCT-64T-BSC-205	Physics of Materials	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	IV	3	CCT-64T-BSC-206	Quantum Chemistry	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	IV	4	CCT-64T-BSC-207	Numerical Methods	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	IV	5	CCT-64T-BSC-208	Bio-Statistics	BSC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	IV	6	CCT-64T-PCC-204	Microbiology	PCC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	IV	7	CCT-64T-PCC-205	Database Management System	PCC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
2	IV	8	CCT-64T-PCC-206	System Analysis and Design	PCC	**2**	2	0	0	**2**	50	15	4	1	60	16	3
2	IV	9	CCT-64P-PCC-223	Microbiology Lab	PCC	**2**	0	0	4	**4**	50	10	4	2	40	16	4
2	IV	10	CCT-64P-ESC-222	Tinkering Lab	ESC	**2**	0	0	4	**4**	50	15	4	2	60	16	4
2	IV	11	CCT-64P-ESC-223	LAMP Project Lab	ESC	**2**	0	0	4	**4**	50	10	4	2	40	16	4
2	IV	12	CCT-64F-MC-202	Constitution of India	MC	**0**	2	0	0	**2**							
						22	**18**	**0**	**12**	**30**							

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Semester	Category	HSMC	BSC	ESC	PCC	PEC	OEC	LC	MC	Total
IV	Credit	2	8	4	8	0	0	0	0	22

Fifth Semester

Year	Semester	S. No.	Course Code	Course Title	Subject Area	Credits	Contacts Hours/Week				Total Marks	CA			EoSE		
							L	T	P	Total		Max. Marks	Min. Marks	MidtermTest Duration	Max. Marks	Min. Marks	Duration
3	V	1		HSMC Elective 1	HSMC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
3	V	2	CCT-75T-PCC-301	Introduction to Nanotechnology	PCC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
3	V	3	CCT-75T-PCC-302	Introduction to Nano-Electronics	PCC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
3	V	4	CCT-75T-PCC-303	Recombinant DNA Technology	PCC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
3	V	5	CCT-75T-PCC-304	Introduction to Bioinformatics	PCC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
3	V	6	CCT-75T-PCC-305	Artificial Intelligence	PCC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
3	V	7	CCT-75T-PCC-306	Functional Programming Language	PCC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
3	V	8	CCT-75T-PCC-307	Introduction to Cognitive Science	PCC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
3	V	9	CCT-75T-PCC-308	Introduction to Neuroscience	PCC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
3	V	10	CCT-75P-PCC-321	Nano Synthesis Laboratory	PCC	**2**	0	0	4	**4**	50	10	4	2	40	16	4
3	V	11	CCT-75P-PCC-322	Recombinant DNA Lab	PCC	**2**	0	0	4	**4**	50	10	4	2	40	16	4
3	V	12	CCT-75P-PCC-323	Functional Programming Language Lab	PCC	**2**	0	0	4	**4**	50	10	4	2	40	16	4

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3	V	13	CCT-75F-MC-301	Anandam-III	MC	**0**	0	0	2	**2**	50				50	20	
						24	**18**	**0**	**14**	**32**							

Semester	Category	HSMCE	BSC	ESC	PCC	PEC	OEC	LC	MC	Total
V	Credit	2	0	0	22	0	0	0	0	24

Sixth Semester

Year	Semester	S. No.	Course Code	Course Title	Subject Area	Credits	Contacts Hours/Week				TotalMarks	CA			EoSE		
							L	T	P	Total		Max. Marks	Min. Marks	MidtermTest Duration	Max. Marks	Min. Marks	Duration
3	VI	1		HSMC Elective 2	HSMC	2	2	0	0	**2**	50	10	4	1	40	16	3
3	VI	2	CCT-76T-PCC-309	Synthesis and Characterization of Nanomaterials	PCC	2	2	0	0	**2**	50	10	4	1	40	16	3
3	VI	3	CCT-76T-PCC-310	Nano-Photonics	PCC	2	2	0	0	**2**	50	10	4	1	40	16	3
3	VI	4	CCT-76T-PCC-311	Metabolic Engineering	PCC	2	2	0	0	**2**	50	10	4	1	40	16	3
3	VI	5	CCT-76T-PCC-312	Omics Science	PCC	2	2	0	0	**2**	50	10	4	1	40	16	3
3	VI	6	CCT-76T-PCC-313	Basic of Quantum Computing	PCC	2	2	0	0	**2**	50	10	4	1	40	16	3
3	VI	7	CCT-76T-PCC-314	Transmission Control Protocol / Internet Protocol	PCC	2	2	0	0	**2**	50	10	4	1	40	16	3
3	VI	8	CCT-76T-PCC-315	Cognitive Neurology	PCC	2	2	0	0	**2**	50	10	4	1	40	16	3
3	VI	9	CCT-76T-PCC-316	Brain Mapping & Engineering	PCC	2	2	0	0	**2**	50	10	4	1	40	16	3
3	VI	10	CCT-76P-PCC-324	Nanomaterial Synthesis Lab	PCC	2	0	0	4	**4**	50	10	4	2	40	16	4

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3	VI	11	CCT-76P-PCC-325	Bioinformatics Lab	PCC	2	0	0	4	**4**	50	10	4	2	40	16	4
3	VI	12	CCT-76P-PCC-326	MATLAB/SCILAB Programming Lab	PCC	2	0	0	4	**4**	50	10	4	2	40	16	4
3	VI	13	CCT-76F-MC-302	Indian Knowledge System	MC	0	2	0	0	**2**	50				50	20	
						24	**20**	**0**	**12**	**32**							

Semester	Category	HSMCE	BSC	ESC	PCC	PEC	OEC	LC	MC	Total
VI	Credit	2	0	0	22	0	0	0	0	24

Seventh Semester

Year	Semester	S. No.	Course Code	Course Title	Subject Area	Credits	L	T	P	Total	Total Marks	Max. Marks	Min. Marks	Midterm Test Duration	Max. Marks	Min. Marks	Duration
4	VII	1		HSMC Elective 3	HSMC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
4	VII	2		Four Electives from Nano/Bio/Info/Cogno Group as Major	PEC	**4x3 = 12**	12	0	0	**12**	50	10	4	1	40	16	3
4	VII	3		Two Electives Lab from Nano/Bio/Info/Cogno Group as Major	PEC	**2 x 2 =4**	0	0	8	**8**	50	10	4	1	40	16	3
4	VII	4		Two Elective from Nano/Bio/Info/Cogno Group as Minor other than Major	OEC	**2x3=6**	6	0	0	**6**	50	10	4	1	40	16	3
4	VII	5		One Elective Lab from Nano/Bio/Info/Cogno Group as a Minor other than Major	OEC	**2**	0	0	4	**4**	50	10	4	1	40	16	3
4	VII	6	CCT-89F-LC-401	NBIC Research Review Project	LC	**4**	0	0	0	**0**	50	10	4	2	40	16	4
						30	**20**	**0**	**12**	**32**							

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Semester	Category	HSMCE	BSC	ESC	PCC	PEC	OEC	LC	MC	Total
VII	Credit	2	0	0	0	16	8	4	0	30

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Eighth Semester

Year	Semester	S. No.	Course Code	Course Title	Subject Area	Credits	L	T	P	Total	Total Marks	Max. Marks	Min. Marks	MidtermTest Duration	Max. Marks	Min. Marks	Duration
4	VIII	1		HSMC Elective 4	HSMC	**2**	2	0	0	**2**	50	10	4	1	40	16	3
4	VIII	2		Four Electives from Nano/Bio/Info/Cogno Group as Major	PEC	**4x3 = 12**	12	0	0	**12**	50	10	4	1	40	16	3
4	VIII	3		Two Electives Lab from Nano/Bio/Info/Cogno Group as Major	PEC	**2 x 2 =4**	0	0	8	**8**	50	10	4	1	40	16	3
4	VIII	4		Two Elective from Nano/Bio/Info/Cogno Group as Minor other than Major	OEC	**2x3=6**	6	0	0	**6**	50	10	4	1	40	16	3
4	VIII	5		One Elective Lab from Nano/Bio/Info/Cogno Group as a Minor other than Major	OEC	**2**	0	0	4	**4**	50	10	4	1	40	16	3
4	VIII	6	CCT-89F-LC-402	Review of Research Papers	LC	**2**	0	0	0	**0**	50	10	4	2	40	16	4
4	VIII	7	CCT-89I-LC-403	SUMMER INTERNSHIP	LC	**10**											
						28/38	**20**	**0**	**12**	**32**							

Semester	Category	HSMCE	BSC	ESC	PCC	PEC	OEC	LC	MC	Total
VIII	Credit	2	0	0	0	16	8	2+10	0	28+10

Note: If a student wishes to exit, he/she has to complete the summer internship of 300 hours = 10 credits for other students it is optional

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Ninth Semester

Year	Semester	S. No.	Course Code	Course Title	Subject Area	Credits	L	T	P	Total	Total Marks	Max. Marks	Min. Marks	Midterm Test Duration	Max. Marks	Min. Marks	Duration
5	IX	1		Three Electives from Nano/Bio/Info/Cogno Group as Major	PE	**3x3 = 9**	9	0	0	**9**	50	10	4	1	40	16	3
5	IX	2		one Electives Lab from Nano/Bio/Info/Cogno Group as Major	PE	**2**	0	0	4	**4**	50	10	4	1	40	16	3
5	IX	3		One Elective from Nano/Bio/Info/Cogno Group as a Minor other than Major	OE	**3**	3	0	0	**3**	50	10	4	1	40	16	3
5	IX	4		One Elective Lab from Nano/Bio/Info/Cogno Group as a Minor other than Major	OE	**2**	0	0	4	**4**	50	10	4	1	40	16	3
5	IX	5	CCT-89F-LC-501	IPR, Innovation and Case Study	LC	**4**	0	0	8	**8**	50	10	4	2	40	16	4
						20	**12**	**0**	**16**	**28**							

Semester	Category	HSMCE	BSC	ESC	PCC	PEC	OEC	LC	MC	Total
IX	**Credit**	**0**	**0**	**0**	**0**	**11**	**5**	**4**	**0**	**20**

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Tenth Semester

Year	Semester	S. No.	Course Code	Course Title	Subject Area	Credits	L	T	P	Total	Total Marks	Max. Marks	Min. Marks	Midterm Test Duration	Max. Marks	Min. Marks	Duration
5	X	1	CCT-8XI-LC-502	Internship/Industrial Training	LC	**20**	0	0	0	**20**							
						20	0	0	0	**20**							

Semester	HSMC	BSC	ESC	PCC	PEC	OEC	LC	MC	Total
I	2	14	8	0	0	0	0	0	24

II	2	14	8	0	0	0	0	0	24
III	2	8	4	10	0	0	0	0	24
IV	2	8	4	8	0	0	0	0	22
V	2	0	0	22	0	0	0	0	24
VI	2	0	0	22	0	0	0	0	24
VII	2	0	0	0	16	8	4	-	30
VIII	2	0	0	0	16	8	2+10	-	28+10
	16	44	24	62	32	16	6+10	-	200+10
IX	0	0	0	0	11	5	4	0	20
X	0	0	0	0	0	0	20	0	20
	16	44	24	62	43	21	30	0	240

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GENERALCOURSESTRUCTURE& THEME

A. DefinitionofCredit:

1Hr. Lecture(L)per week	1 Credit
1Hr.Tutorial(T)perweek	1 Credit
2HoursPractical(P)per week	1 Credit

B. Credits: For Four-yearB.Tech. degreeprogramin Converging Technologycandidates are required to earn a total of 210 credits. For Dual Degree B.Tech.-M.Tech. in converging Technology candidatesare required to earn a total of 240 credits.

C. Structure of UG Program Thestructureof B.Tech. and Dual Degree B. Tech.-M.Tech.programin Converging Technology shall have essentiallythe followingcategories of courses with the breakup of credits as given:

S.No.	Category	CreditBreakupfor B. Tech.	CreditBreakupfor Dual Degree B. Tech.-M.Tech.
1	HumanitiesandSocialSciencesincludingManagementcourses	16	16
2	BasicSciencecourses	44	44
3	EngineeringSciencecoursesincludingworkshop,drawing,basics of electronics/electrical/mechanical/computer etc.	24	24
4	Professionalcorecourses	62	62
5	ProfessionalElectivecoursesrelevanttochosen specialization/branch	32	43
6	Opensubjects–Electivesfromothertechnicaland/oremerging subjects	16	21
7	Projectwork,seminarandinternshipinindustryorelsewhere	16	30
8	MandatoryCourses [EnvironmentalSciences,InductionProgram,IndianConstitution, Essence of Indian Knowledge Tradition]	(non-credit)	(non-credit)
	Total	**210**	**240**

D. Coursecodeand definition:

Coursecode	Definitions
L	Lecture
T	Tutorial

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P	Practical
C	Credits
BSC	BasicScienceCourses
ESC	EngineeringScienceCourses

Category Code	Category
HSMC	HumanitiesandSocialSciencesincluding Managementcourses
PCC	Professionalcorecourses
PEC	ProfessionalElectivecoursesrelevantto the chosen specialization/branch
OEC	Opensubjects–Electivesfromothertechnicaland/oremerging subjects
LC	Projectwork,seminarandinternshipinindustryorelsewhere
MC	Mandatorycourses

- **Courselevelcodingscheme:**Three-digitnumber(oddnumbersarefortheoddsemester courses and even numbers are for even semester courses) used as a suffix with the Course Codeforidentifyingthelevelofthecourse.The digitathundred'splacesignifiesthe yearin which the course is offered. e.g.
  101, 102 … etc.
  for first year.
  201,202….Etc.fo
  rsecondyear. 301,
  302 … for third
  year.

- **Category-wiseCourses**

HSMC Courses

S. No.	Course Code	Course Name	Credit	Semester
1.	CCT-51T-HSMC-101	Communication Skills	2	I
2.	CCT-52T-HSMC-102	Scientific Writing	2	II
3.	CCT-63T-HSMC-201	Industrial Economics	2	III
4.	CCT-64T-HSMC-202	Entrepreneurship	2	IV
			12	

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HSMC Elective Courses

S. No.	Course Code	Course Name	Credit	Semester
1.	CCT-HSMC-E1	Management for Managers	2	Any Four From V To VIII
2.	CCT-HSMC-E2	Digital Marketing	2	
3.	CCT-HSMC-E2	Cyber Crime and Digital Empowerment	2	
4.	CCT-HSMC-E4	The Social Lens: An Exploration of Sociology	2	
5.	CCT-HSMC-E5	Understanding Indian Society: A Sociological Perspective	2	
6.	CCT-HSMC-E6	Introduction to Indian Culture	2	
7.	CCT-HSMC-E7	Introduction to Indian History	2	

BSC Courses

S. No.	Course Code	Course Name	Credit	Semester
1.	CCT-51T-BSC-101	Physics-I	2	I
2.	CCT-51T-BSC-102	Chemistry-I	2	I
3.	CCT-51T-BSC-103	Mathematics-I	2	I
4.	CCT-51T-BSC-104	Genetics	2	I
5.	CCT-51P-BSC-121	Physics Lab - I	2	I
6.	CCT-51P-BSC-122	Chemistry Lab -I	2	I
7.	CCT-51P-BSC-123	Life Sciences Lab	2	I
8.	CCT-52T-BSC-105	Physics-II	2	II
9.	CCT-51T-BSC-106	Chemistry-II	2	II
10.	CCT-52T-BSC-107	Mathematics-II	2	II
11.	CCT-52T-BSC-108	Cell Biology	2	II
12.	CCT-52P-BSC-124	Physics Lab - II	2	II
13.	CCT-52P-BSC-125	Chemistry Lab - II	2	II
14.	CCT-52P-BSC-126	Cell Biology Lab	2	II
15.	CCT-63T-BSC-201	Quantum Physics	2	III
16.	CCT-63T-BSC-202	Principle and Application of Molecular Spectroscopy	2	III
17.	CCT-63T-BSC-203	Advanced Mathematics	2	III
18.	CCT-63T-BSC-204	Development Biology	2	III

S. No.	Course Code	Course Name	Credit	Semester
19.	CCT-64T-BSC-205	Physics of Materials	2	IV
20.	CCT-64T-BSC-206	Quantum Chemistry	2	IV
21.	CCT-64T-BSC-207	Numerical Methods	2	IV
22.	CCT-64T-BSC-208	Bio-Statistics	2	IV
			44	

ESC Courses

S. No.	Course Code	Course Name	Credit	Semester
1.	CCT-51T-ESC-101	Programming in C	2	I
2.	CCT-51T-ESC-102	Biochemistry	2	I
3.	CCT-51T-ESC-103	Basic Psychological Processes	2	I
4.	CCT-51P-ESC-121	Programming in C Lab	2	I
5.	CCT-52T-ESC-104	Semiconductor Electronics Devices and Applications	2	II
6.	CCT-52T-ESC-105	Object Oriented Programming	2	II
7.	CCT-52T-ESC-122	Semiconductor Electronics Lab	2	II
8.	CCT-52P-ESC-123	C++ Programming Lab	2	II
9.	CCT-63T-ESC-201	Programming in Java	2	III
10.	CCT-63P-ESC-221	Java Programming Lab	2	III
11.	CCT-64P-ESC-222	Tinkering Lab	2	IV
12.	CCT-64P-ESC-223	LAMP Project Lab	2	IV
			24	

PCC Courses

S. No.	Course Code	Course Name	Credit	Semester
1.	CCT-63T-PCC-201	Solid State Physics	2	III
2.	CCT-63P-PCC-202	Molecular Biology	2	III
3.	CCT-63P-PCC-203	Cognitive Psychology	2	III
4.	CCT-63T-PCC-221	Material Science Lab	2	III
5.	CCT-63P-PCC-222	Psychology Lab	2	III
6.	CCT-63T-PCC-204	Microbiology	2	IV
7.	CCT-64T-PCC-205	Database Management System	2	IV
8.	CCT-64T-PCC-206	System Analysis and Design	2	IV
9.	CCT-64T-PCC-223	Microbiology Lab	2	IV
10.	CCT-64T-PCC-207	System Analysis and Design	2	IV
11.	CCT-75T-PCC-301	Introduction to Nanotechnology	2	V

S. No.	Course Code	Course Name	Credit	Semester
12.	CCT-75T-PCC-302	Introduction to Nano-electronics	2	V
13.	CCT-75T-PCC-303	Recombinant DNA Technology	2	V
14.	CCT-75T-PCC-304	Introduction to Bio-informatics	2	V
15.	CCT-75T-PCC-305	Artificial Intelligence	2	V
16.	CCT-75T-PCC-306	Functional Programming Language	2	V
17.	CCT-75T-PCC-307	Introduction to Cognitive Science	2	V
18.	CCT-75T-PCC-308	Introduction to Neuroscience	2	V
19.	CCT-75T-PCC-321	Nano Synthesis Laboratory	2	V
20.	CCT-75P-PCC-322	Recombinant DNA Lab	2	V
21.	CCT-75P-PCC-323	Functional Programming Language Lab	2	V
22.	CCT-76T-PCC-309	Synthesis and Characterization of Nanomaterials	2	VI
23.	CCT-76T-PCC-310	Nano-Photonics	2	VI
24.	CCT-76T-PCC-311	Metabolic Engineering	2	VI
25.	CCT-76T-PCC-312	Omics Science	2	VI
26.	CCT-76T-PCC-313	Basic of Quantum Computing	2	VI
27.	CCT-76T-PCC-314	Transmission Control Protocol / Internet Protocol	2	VI
28.	CCT-76T-PCC-315	Cognitive Neurology	2	VI
29.	CCT-76T-PCC-316	Brain Mapping & Engineering	2	VI
30.	CCT-76T-PCC-324	Nanomaterial Synthesis Lab	2	VI
31.	CCT-76P-PCC-325	Bioinformatics Lab	2	VI
32.	CCT-76P-PCC-326	MATLAB/SCILAB Programming	2	VI
			64	

PEC Courses

S. No.	Course Code	Course Name	Credit	Semester	Group
1.	CCT-87T- PEC-401N	Optoelectronics Devices	3	VII	Nano
2.	CCT-87T- PEC-402N	Polymer Engineering	3	VII	
3.	CCT-87T- PEC-403N	Computational Nanotechnology	3	VII	
4.	CCT-87T- PEC-404N	Nanocomposites	3	VII	
5.	CCT-87T- PEC-421N	Nanomaterial Fabrication and Characterization Lab	2	VII	
6.	CCT-87T- PEC-422N	Computational Nanotechnology Lab	2	VII	
7.	CCT-87T- PEC-401B	Agriculture Biotechnology	3	VII	Bio
8.	CCT-87T- PEC-402B	Bioprocess Engineering and Technology	3	VII	
9.	CCT-87T- PEC-402B	Bioinformatics	3	VII	

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S. No.	Course Code	Course Name	Credit	Semester	Group
10.	CCT-87T- PEC-402B	Molecular Biotechnology	3	VII	
11.	CCT-87T- PEC-421B	Biotechnology Lab	2	VII	
12.	CCT-87T- PEC-422B	Bioinformatics Lab	2	VII	
13.	CCT-87T- PEC-401I	Computer Graphics	3	VII	
14.	CCT-87T- PEC-402I	Optical Fiber Communication	3	VII	
15.	CCT-87T- PEC-402I	Design and Analysis of Algorithm	3	VII	
16.	CCT-87T- PEC-402I	Machine Learning	3	VII	Info
17.	CCT-87T- PEC-421B	Algorithm Implementation Lab	2	VII	
18.	CCT-87T- PEC-422B	Server Installation and Configuration Lab	2	VII	
19.	CCT-87T- PEC-401C	Philosophy of Mind	3	VII	
20.	CCT-87T- PEC-402C	Principles& Techniques of Neuroscience	3	VII	
21.	CCT-87T- PEC-402C	Introduction to Dynamical Systems for Neuroscience	3	VII	Cogno
22.	CCT-87T- PEC-402C	Introduction to Computational Neuroscience	3	VII	
23.	CCT-87T- PEC-421C	Cognitive Lab	2	VII	
24.	CCT-87T- PEC-422C	Neurosciences Lab	2	VII	
25.	CCT-88T- PEC-405N	Molecular Nanoelectronics	3	VIII	
26.	CCT-88T- PEC-406N	Nano Devices and Nano Sensors	3	VIII	
27.	CCT-88T- PEC-407N	Application of Nanosciences	3	VIII	
28.	CCT-88T- PEC-408N	Advanced Material Characterization	3	VIII	Nano
29.	CCT-88T- PEC-423N	Nanocomposite Lab	2	VIII	
30.	CCT-88T- PEC-424N	Microscopy and Diffraction Lab	2	VIII	
31.	CCT-88T- PEC-405B	Animal Cell Culture	3	VIII	
32.	CCT-88T- PEC-406B	Proteomics	3	VIII	
33.	CCT-88T- PEC-407B	Chemo Bioinformatics & Drug Designing	3	VIII	Bio
34.	CCT-88T- PEC-408B	Advanced Immunology	3	VIII	
35.	CCT-88T- PEC-423B	Animal Cell Culture Lab	2	VIII	
36.	CCT-88T- PEC-424B	Computational Biology Lab	2	VIII	
37.	CCT-88T- PEC-405I	Microwave Communication	3	VIII	
38.	CCT-88T- PEC-406I	Network Security and Cryptography	3	VIII	
39.	CCT-88T- PEC-407I	Parallel Computing	3	VIII	Info
40.	CCT-88T- PEC-408I	Network Security Lab	3	VIII	
41.	CCT-88T- PEC-423I	Artificial Intelligence Lab	2	VIII	
42.	CCT-88T- PEC-424I	Techniques in Artificial	2	VIII	

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S. No.	Course Code	Course Name	Credit	Semester	Group
		Intelligence			
43.	CCT-88T- PEC-405C	Sensation and Perception	3	VIII	Cogno
44.	CCT-88T- PEC-406C	Psycho Neurolinguistics	3	VIII	
45.	CCT-88T- PEC-407C	Clinical Neuroscience	3	VIII	
46.	CCT-88T- PEC-408C	Neuroimaging and Cognition	3	VIII	
47.	CCT-88T- PEC-423C	Neurolinguistics Lab	2	VIII	
48.	CCT-88T- PEC-424C	Brain Imaging Lab	2	VIII	
49.	CCT-89T- PEC-501N	Quantum Transport	3	IX	Nano
50.	CCT-89T- PEC-502N	Soft Matter Physics	3	IX	
51.	CCT-89T- PEC-503N	Carbon Nanotechnology	3	IX	
52.	CCT-89T- PEC-521N	Advanced Nanomaterials Lab	2	IX	
53.	CCT-89T- PEC-501B	Food Biotechnology	3	IX	Bio
54.	CCT-89T- PEC-502B	Industrial Biotechnology	3	IX	
55.	CCT-89T- PEC-503B	Advance Tool and Technique	3	IX	
56.	CCT-89T- PEC-521B	Advanced Biotechnology Lab	2	IX	
57.	CCT-89T- PEC-501I	Digital Communication and Signal Processing	3	IX	Info
58.	CCT-89T- PEC-502I	Operating System Engineering	3	IX	
59.	CCT-89T- PEC-503I	Advanced Informatics Lab	3	IX	
60.	CCT-89T- PEC-521I	Mobile & Pervasive Computing	2	IX	
61.	CCT-89T- PEC-501C	Neuropharmacology and Neurotoxicology	3	IX	Cogno
62.	CCT-89T- PEC-502C	Neurological and Psychiatric Disorders	3	IX	
63.	CCT-89T- PEC-503C	Computational and Modelling in Neuroscience	3	IX	
64.	CCT-89T- PEC-521C	Advanced Cognitive Science Lab	2	IX	

OEC Courses

S. No.	Course Code	Course Name	Credit	Semester	Group
1.	CCT-87T- PEC-401N	Optoelectronics Devices	3	VII	Nano
2.	CCT-87T- PEC-402N	Polymer Engineering	3	VII	
3.	CCT-87T- PEC-403N	Computational Nanotechnology	3	VII	
4.	CCT-87T- PEC-404N	Nanocomposites	3	VII	
5.	CCT-87P- PEC-421N	Nanomaterial Fabrication and Characterization Lab	2	VII	
6.	CCT-87P- PEC-422N	Computational Nanotechnology Lab	2	VII	

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S. No.	Course Code	Course Name	Credit	Semester	Group
7.	CCT-87T- PEC-401B	Agriculture Biotechnology	3	VII	Bio
8.	CCT-87T- PEC-402B	Bioprocess Engineering and Technology	3	VII	
9.	CCT-87T- PEC-402B	Bioinformatics	3	VII	
10.	CCT-87T- PEC-402B	Molecular Biotechnology	3	VII	
11.	CCT-87P- PEC-421B	Biotechnology Lab	2	VII	
12.	CCT-87P- PEC-422B	Bioinformatics Lab	2	VII	
13.	CCT-87T- PEC-401I	Computer Graphics	3	VII	Info
14.	CCT-87T- PEC-402I	Optical Fiber Communication	3	VII	
15.	CCT-87T- PEC-402I	Design and Analysis of Algorithm	3	VII	
16.	CCT-87T- PEC-402I	Machine Learning	3	VII	
17.	CCT-87P- PEC-421B	Algorithm Implementation Lab	2	VII	
18.	CCT-87P- PEC-422B	Server Installation and Configuration Lab	2	VII	
19.	CCT-87T- PEC-401C	Philosophy of Mind	3	VII	Cogno
20.	CCT-87T- PEC-402C	Principles& Techniques of Neuroscience	3	VII	
21.	CCT-87T- PEC-402C	Introduction to Dynamical Systems for Neuroscience	3	VII	
22.	CCT-87T- PEC-402C	Introduction to Computational Neuroscience	3	VII	
23.	CCT-87P- PEC-421C	Cognitive Lab	2	VII	
24.	CCT-87P- PEC-422C	Neurosciences Lab	2	VII	
25.	CCT-88T- PEC-405N	Molecular Nanoelectronics	3	VIII	Nano
26.	CCT-88T- PEC-406N	Nano Devices and Nano Sensors	3	VIII	
27.	CCT-88T- PEC-407N	Application of Nanosciences	3	VIII	
28.	CCT-88T- PEC-408N	Advanced Material Characterization	3	VIII	
29.	CCT-88P- PEC-423N	Nanocomposite Lab	2	VIII	
30.	CCT-88P- PEC-424N	Microscopy and Diffraction Lab	2	VIII	
31.	CCT-88T- PEC-405B	Animal Cell Culture	3	VIII	Bio
32.	CCT-88T- PEC-406B	Proteomics	3	VIII	
33.	CCT-88T- PEC-407B	Chemo Bioinformatics & Drug Designing	3	VIII	
34.	CCT-88T- PEC-408B	Advanced Immunology	3	VIII	
35.	CCT-88P- PEC-423B	Animal Cell Culture Lab	2	VIII	
36.	CCT-88P- PEC-424B	Computational Biology Lab	2	VIII	
37.	CCT-88T- PEC-405I	Microwave Communication	3	VIII	Info
38.	CCT-88T- PEC-406I	Network Security and Cryptography	3	VIII	

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S. No.	Course Code	Course Name	Credit	Semester	Group
39.	CCT-88T- PEC-407I	Parallel Computing	3	VIII	
40.	CCT-88P- PEC-408I	Network Security Lab	3	VIII	
41.	CCT-88P- PEC-423I	Artificial Intelligence Lab	2	VIII	
42.	CCT-88T- PEC-424I	Techniques in Artificial Intelligence	2	VIII	
43.	CCT-88T- PEC-405C	Sensation and Perception	3	VIII	Cogno
44.	CCT-88T- PEC-406C	Psycho Neurolinguistics	3	VIII	
45.	CCT-88T- PEC-407C	Clinical Neuroscience	3	VIII	
46.	CCT-88T- PEC-408C	Neuroimaging and Cognition	3	VIII	
47.	CCT-88P- PEC-423C	Neurolinguistics Lab	2	VIII	
48.	CCT-88P- PEC-424C	Brain Imaging Lab	2	VIII	
49.	CCT-89T- PEC-501N	Quantum Transport	3	IX	Nano
50.	CCT-89T- PEC-502N	Soft Matter Physics	3	IX	
51.	CCT-89T- PEC-503N	Carbon Nanotechnology	3	IX	
52.	CCT-89P- PEC-521N	Advanced Nanomaterials Lab	2	IX	
53.	CCT-89T- PEC-501B	Food Biotechnology	3	IX	Bio
54.	CCT-89T- PEC-502B	Industrial Biotechnology	3	IX	
55.	CCT-89T- PEC-503B	Advanced Tool and Technique	3	IX	
56.	CCT-89P- PEC-521B	Advanced Biotechnology Lab	2	IX	
57.	CCT-89T- PEC-501I	Digital Communication and Signal Processing	3	IX	Info
58.	CCT-89T- PEC-502I	Operating System Engineering	3	IX	
59.	CCT-89T- PEC-503I	Advanced Informatics Lab	3	IX	
60.	CCT-89P- PEC-521I	Mobile & Pervasive Computing	2	IX	
61.	CCT-89T- PEC-501C	Neuropharmacology and Neurotoxicology	3	IX	Cogno
62.	CCT-89T- PEC-502C	Neurological and Psychiatric Disorders	3	IX	
63.	CCT-89T- PEC-503C	Computational and Modelling in Neuroscience	3	IX	
64.	CCT-89P- PEC-521C	Advanced Cognitive Science Lab	2	IX	

Mandatory Courses

S. No.	Course Code	Course Name	Credit	Semester
1.	CCT-51F-MC-101	Anandam-I	0	I
2.	CCT-52T-MC-102	Environmental Studies	0	II
3.	CCT-63F-MC-201	Anandam-II	0	III

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4.	CCT-64T-MC-202	Constitution of India	0	IV
5.	CCT-75F-MC-301	Anandam-III	0	V
6.	CCT-76T-MC-302	Indian Knowledge System	0	VI

E. EvaluationScheme

a. **ForTheoryCourses:**
(The weightage of Internal assessment is 20% and for End Semester Exam is 80%)
Thestudenthastoobtainatleast40%marksindividuallybothininternalassessment and end-semester exams to pass.

b. **ForPractical Courses:**
(The weightage of Internal assessment is 20% and for End Semester Exam is 80%)
Thestudenthastoobtainatleast40%marksindividuallybothininternalevaluation and end-semester exams to pass.

c. ForSummerInternship/Projects/Seminaretc.
Evaluationisbasedonworkdone,report quality,performanceinviva voce, presentation etc.

Note: The internal assessment is based on the student's performance in mid-semester tests, quizzes, assignments, class performance, attendance, viva voce in practical, lab record etc.

F. MappingofMarkstoGrades

The mapping of marks to grades may be done as per the following table:

Rangeof Marks	AssignedGrade
91-100	A^+
81-90	A
71-80	B^+
61-70	B
51-60	C^+
46-50	C
40-45	D
<40	F(Failduetolessmarks)
-	F^R(Failduetoshortageofattendanceandtherefore,torepeatthecourse)

G. Exit Policy:

a) AfterSecond Year:

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Students who opt to exit after completion of the Second year and have secured 100 credits will be awarded a **Diplomain Converging Technology** if, in addition, they complete one internship of 6 credits (180 hours) during the summer vacation of the Second year.

b) AfterThirdYear:

Students who opt to exit after completion of the Third year and have secured 180 credits will be awarded a **B.Voc. (Converging Technologies)** if, in addition, they complete one internship of 6 credits (180 hours) during the summer vacation of the Second year.

c) AfterFourth Year:

Students who opt to exit after completion of the Third year and have secured 180 credits will be awarded a **B.Tech. (Converging Technologies)** if, in addition, they complete one internship of 10 credits (300 hours) during the summer vacation of the Fourth year.

H. Computation of SGPA and CGPA:

The Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) are calculated to measure students' overall performance. The SGPA is computed for each semester by taking the weighted average of the grade points earned in that particular semester, while the CGPA is calculated by considering the weighted average of grade points across all semesters. These indicators provide a comprehensive view of student's academic progress throughout their undergraduate journey.

Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. The SGPA is the ratio of the sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits in all the courses undergone by a student, i.e.

$$\textbf{SGPA } (S_i) = \Sigma(C_i \times G_i) / \Sigma C_i$$

Where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course.

ii. The Cumulative Grade Point Average (CGPA) is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$\textbf{CGPA} = \Sigma(C_i \times S_i) / \Sigma C_i$$

where S_i is the SGPA of the i^{th} semester and C_i is the total number of credits in that semester.

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Note –

1. Marks obtained in each course and a weighted average of marks based on marks obtained in all semesters taken together shall be mentioned in the mark sheet.
2. The Letter grades, Grade Points and SGPA and CGPA shall be issued in the transcript for each semester and a consolidated transcript indicating the performance in all semesters.

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Examination Scheme

1. 1 credit = 25 marks for examination/evaluation
2. For Regular Students there will be Continuous assessment, in which sessional work and the terminal examination will contribute to the final grade. Each course in Semester Grade Point Average (SGPA) has two components- Continuous assessment (20% weightage) and (End of end-semester examination) EoSE (80% weightage).
3. For Regular Students,75% Attendance is mandatory for appearing in the EoSE.
4. To appear in the EoSE examination of a course/subject a regular student must appear in the mid-semester examination and obtain at least a C grade in the course/subject.
5. Credit points in a Course/Subject will be assigned only if, the regular student obtains at least a C grade in the CA and EoSE examination of a Course/Subject.

Examination Scheme for Continuous Assessment (CA)

DISTRIBUTION OF CONTINUOUS ASSESSMENT (CA) MARKS

S. No.	CATEGORY	Weightage (out of total internal marks)		THEORY		PRACTICAL
	Max Internal Marks			**10**	**15**	**10**
1	**Mid-term Exam**	***~50%***		**5**	**8**	**5**
2	**Assignment**	***~25%***		**2.5**	**3.5**	**2.5**
3	**Attendance**	***~25%***		**2.5**	**3.5**	**2.5**
		Regular Class Attendance	= 75%	1	2	1
			75-80%	1.5	2.5	1.5
			80-85%	2	3	2
			> 85%	2.5	3.5	2.5

Note:

1. Continuous assessment will be the sole responsibility of the teacher concerned.
2. For continuous assessment no remuneration will be paid for paper setting, Evaluation, Invigilation etc.

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3. For continuous assessment Paper setting and Evaluation responsibility will be of teacher concern.
4. For continuous assessment no Answer sheets/question papers etc. will be provided by the University.
5. Colleges are advised to keep records of continuous assessment, attendance etc.

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SEMESTER-WISE PAPER TITLES WITH DETAILS

DD0401 – Dual Degree B.Tech.-M.Tech. in Converging Technologies I-Semester							
#	Semester	Type	Title	Credits			
				L	T	P	Total
1.	I	HSMC	CCT-51T- HSMC-101–Communication Skills	2	0	0	2
2.	I	BSC	CCT-51T-BSC-101–Physics-I	2	0	0	2
3.	I	BSC	CCT-51T-BSC-102-Chemistry-I	2	0	0	2
4.	I	BSC	CCT-51T-BSC-103-Mathematics-I	2	0	0	2
5.	I	BSC	CCT-51T-BSC-104-Genetics	2	0	0	2
6.	I	BSC	CCT-51P-BSC-121-Physics Lab - I	0	0	2	2
7.	I	BSC	CCT-51P-BSC-122-Chemistry Lab -I	0	0	2	2
8.	I	ESC	CCT-51P-BSC-123-Life Sciences Lab	0	0	2	2
9.	I	ESC	CCT-51T-ESC-102-Programming in C	2	0	0	2
10.	I	ESC	CCT-51T-ESC-102-Biochemistry	2	0	0	2
11.	I	ESC	CCT-51T-ESC-102-Basic Psychological Processes	2	0	0	2
12.	I	ESC	CCT-51P-ESC-121- Programming in C Lab	0	0	2	2
13.	I	MC	CCT-51F-MC-101-Anandam-I	0	0	0	0
				16	**0**	**08**	**24**

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Syllabus

CCT-51T- HSMC-101: Communication Skills

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
I	CCT-51T- HSMC-101	Communication Skills			5	2
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	HSMC	2	-	2	30 Lectures	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		1. To comprehend the basics of communication skills in formal and informal settings. 2. To enhance the student's ability to understand the process of communication and develop effective communication skills. 3. To develop the art of listening among students by identifying barriers and overcome them. 4. To acquire knowledge of the various means of communication and use them precisely. 5. To improve writing skills for clear, concise, and professional communication in emails, reports, letters, and other written documents.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-51T- HSMC-101– Communication Skills	1 Hrs-CA 1 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

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Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-51T- HSMC-101: Communication Skills

Unit-I

Introduction to Communication

- Meaning and Definition of Communication
- Purpose and Scope of Communication
- Process of Communication
- Importance of Communication Network

(7 Lectures)

Unit-II

Types of Communication

- Verbal and Non-Verbal Communication
- Oral and Written Communication
- Formal and Informal types of Communication
- Understanding Body Language: KOPPACT (Kinesis, Oculesics, Paralanguage, Proxemics, Artifactics, Chromatics, Tactilics)
- Developing and Maintaining Channels of Communication

(8 Lectures)

Unit-III

Effective Communication and Listening Skills

- Principles of Effective Communication
- Seven Cs of Communication
- Understanding Barriers to Effective Communication
- Listening Process: Types of Listening and Barriers to Listening
- Developing Listening Skills
- Feedback

(8 Lectures)

Unit-IV

Developing Writing Skills

- Report Writing
- Business Letters
- Preparing Resume and CV
- Presentation Skills

(7 Lectures)

Suggested Books and References:

1. Messages: The Communication Skills Book byMatthew McKay, Martha Davis, Patrick Fanning, New Harbinger Publications.
2. People Skills: How to Assert Yourself, Listen to Others and Resolve Conflicts by Robert Bolton.
3. The Elements of Style by William Strunk Jr. and E.B. White.
4. How to Speak Effectively: A Guide to Engaging Conversations, Presentations, and Making an Impact on People by Patrick King.
5. Writing Skills (The Business Skills Series) by Anne Laws.

Course Learning Outcomes:

1. Define and understand key concepts of Communication clearly in various contexts, including formal presentations and communication.
2. Analyze the significance of the communication process and its various channels to communicate messages with clarity, appropriate tone, and confidence.
3. It will help demonstrate improved listening skills, including paraphrasing, asking clarifying questions, and providing feedback.
4. Understand the techniques of written and digital media communication to improve digital communication professionally, understand etiquette, and maintain clear and effective exchanges.
5. Refine writing skills and equip with better ways of professional writing.

Syllabus

CCT-51T-BSC-101: Physics-I

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
I	CCT-51T-BSC-101	Physics -I			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	BSC	02	-	02	Lectures	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		The objectives of this course are to provide the fundamental concepts of physics to the students which are useful for applied and engineering physics.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-51T-BSC-101–Physics-I	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts,**A**&**B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-51T-BSC-101-Physics-I

Unit-I

Units, Physical quantities and vectors, Motion along a straight line, Motion in two or three dimensions, Newton's law of motion, Work and Kinetic energy, Potential energy and energy conservation, Momentum, Impulse and collisions, Rotation of rigid bodies, dynamics of rotational motion

[7 Lectures]

Unit-II

Elasticity: Stress, Strain, Elastic limit, Hook's law, Young's modulus, Bulk modulus, Shear modulus, elasticity and plasticity.
Fluid Mechanics: Pressure in a fluid, Pascal's law, Archimedes's principle, Surface tension, continuity equation, Bernoulli's equation, Viscosity and turbulence
Periodic motion: Simple harmonic motion, Energy in simple harmonic motion, simple pendulum, damped oscillations, forced oscillations and resonances

[8 Lectures]

Unit-III

Temperature and thermal equilibrium, zeroth law of thermodynamics, thermal expansion, specific heat, calorimetry and phase changes, mechanism of heat transfer, equations of state and idea gas equation, heat capacity, the internal energy and the first law of thermodynamics, Kinds of thermodynamic processes, internal energy and heat capacities of an ideal gas, heat engines, refrigerators, Second law of thermodynamics, the Carnot cycle, Entropy

[7 Lectures]

Unit-IV

Interference, conditions for interference, interference by division of wavefront and by division of amplitude, diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at the single slit and double slit, diffraction grating, characteristics of diffraction grating and its applications, Polarization, Linear, circular and elliptical polarization, polarization by reflection, refraction and scattering, Laser, Spontaneous and stimulated emission

[8 Lectures]

Suggested Books and References:

1. Young and Freedman, University Physics, Pearson.
2. D.S. Mathur, Elements of Properties of Matter, S.Chand Publishing.
3. Eugene Hecht, Optics, Pearson publication, 2017.
4. Ajoy Ghatak, Optics, McGraw Hill Education (Indian Edition), 2017.
5. H.K. Malik and A. K. Singh, Engineering Physics, McGraw Hill Education (Indian Edition), 2018.

Course Learning Outcomes:

After completion of this course, students will be able to:

- Understand the properties of matter such as elasticity, viscosity and surface tension.
- Gain a piece of knowledge about concepts of thermodynamics and also learn about heat engines, refrigerators, Carnot cycle.
- Understand the different phenomena in optics and learn about lasers.

Syllabus

CCT-51T-BSC-102-Chemistry-I

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
I	CCT-51T-BSC-102	Chemistry-I			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	BSC	02	-	02	30 Lectures, including diagnostic and formative assessments	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		1. To enable students to acquire a skill set that helps them to understand the basics of physical chemistry. 2. To impart an understanding of all the aspect of physical chemistry eg. Solid state, liquid state, electrochemistry, chemical kinetics and colloidal state with heterogeneous equilibria.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-51T-BSC-101–Physics-I	1 Hrs-CA 1 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-51T-BSC-101-Chemistry-I

UNIT-I

Liquid and Solid State

A) Liquid state:

Intermolecular forces, structure of liquid (a qualitative description), properties of liquid: vapour pressure, viscosity and surface tension and their variation with the temperature.

Liquid crystals: mesomorphic state classification, structure of smectic, nematic and cholesteric liquid crystals.

B) Solid state:

Symmetry of crystal systems Space lattice, unit cell, laws of crystallography: 1) law of constancy of interfacial angles, 2) law of rationality of indices and 3) law of symmetry of crystal systems.

X-ray diffraction by crystals, Bragg's equation. Determination of crystal structure by powder method. Examples-NaCl, CsCl.

(8Lectures)

UNIT-II

Colloidal state and Heterogenous Equilibrium

A) Colloidal state:

Differences between true and colloidal solution. Classification (lyophilic and lyophobic colloids), preparation, properties (optical and electrical-Tyndall effect, Brownian effect, electrophoresis and electro-osmosis), electrical double layer, coagulation and protective action of colloids, applications of colloids, surfactants, micelles, critical micelle concentration (CMC), method of determination of CMC.

B) Heterogenous equilibrium:

Law of mass action as applied to the decomposition of $CaCO_3$, $CuSO_4.5H_2O$. Phase, Component and Phase rule, Restricted phase rule and One-component system-water and Sulphur, Two-component system-lead and silver systems (desilverasation of lead).

(8 Lectures)

UNIT-III

Chemical Kinetics and Catalysts

Rate of reaction, Factors influencing the rate of reaction (concentration, temperature, pressure, catalyst), Order and molecularity of complex reactions(no mechanism) mathematical characteristics of simple chemical reaction-zero order, first order and second order and half life. Determination of the order of reaction by differential rate method, integration and half-life method. Experimental methods of chemical kinetics: conductometric, potentiometric methods. Effect of catalyst (using steady-state approximation). Arrhenius equation and its relation with activation energy

(6 Lectures**)**

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UNIT-IV

Electrochemistry and Classical thermodynamics

A) Electrolytic and electrochemical cells:

Gibb's free energy and cell potential, Nernst equation, single electrode potential, metal-metal ion electrode, gas electrode, metal-insoluble metal electrodes,oxidation-reduction electrode, determination of EMF of the cell and cell reactions.

B) Classical chemical thermodynamics

Statement of first law of thermodynamics, reversible expansion processes of an ideal gas at constant volume and constant pressure, the relationship between enthalpy(H) and internal energy(U), Enthalpy change of combustion reaction($\Delta H_{combustion}$), acidbase neutralization, enthalpy of formation of compounds, Hess's law of constant heat summation and limitations of first law of thermodynamics.

(8Lectures)

Suggested Books and References–

1. Physical chemistry by P.W. Atkins.
2. Chemical kinetics by Frost and Pearson.
3. Physical chemistry by B.R. Puri, L.R. Sharma and M.S. Pathania.
4. Element of physical chemistry by Lewis &Glasstone.

Course Learning Outcomes:

The prescribed syllabus expects that the students would get exposure to various aspects of physical chemistry in the curriculum more contextually and systematically as they study its various units.

The course will enable the students to:

- Learn about the basics of physical chemistry and its applications.
- Acquire knowledge about the various aspects of classical thermodynamics.
- Understand the role of catalyst kinetics.
- Learn fundamental concepts of states of matter (liquid and solid state).

Syllabus

CCT-51T-BSC-103-Mathematics-I

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
I	CCT-51T-BSC-103	MATHEMATICS-I			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	BSC	02	-	02	30 Lectures	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		The objective of the course is to master the fundamental concepts in each topic area, with an emphasis on understanding, application, and problem-solving.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-51T-BSC-103– Mathematics-I	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-51T-BSC-103-Mathematics-I

UNIT-I

Complex Numbers: Definition, real and imaginary parts, complex conjugate, representation of a complex number in a plane, modulus and argument of a complex number, algebra of complex numbers, cube root of unity.
Permutation and Combination: Fundamental principle of counting, factorial notation, permutation mean of P(n,r), and combination mean of C(n,r). Applications of permutation and combination.

(7 Lectures)

UNIT-II

Sequences and Series: Sequence and series (finite and infinite), n^{th} term, arithmetical progression (A.P.), sum of n terms of an A.P., arithmetic mean (G.M.), Geometric progression (G.P.), sum of n terms and infinite terms of a G.P., Geometric mean (G.M.), Harmonic progression (H.P.), Harmonic mean (H.M.), relation between A.M., G.M., H.M., series representation of exponential functions, logarithmic functions, e^x and $\log(1+x)$.

(8 Lectures)

UNIT-III

Matrices and Determinants: Concept of a matrix, Types of matrices, Transpose and adjoint of a matrix, addition, and multiplication of matrices, rank of matrix, elementary row, and column transformations, the inverse of a matrix, solutions of linear equations in two or three variables using the inverse of a matrix, Determinants of a square matrix.

(7 Lectures)

UNIT-IV

Two-Dimensional Co-ordinate Geometry: Cartesian coordinate system, distance, and section formula, condition for collinearity of three points in a plane, equation of a straight-line slope form, intercept form, general form, parallel and perpendicular line, intercept of a line, the angle between two lines, distance of a point from a line.

(8 Lectures)

Suggested Books and References –

1. Higher Algebra, Hall & Knight, Arihant Publications India Limited, 2019.

2. Problems in Calculus of One Variable, I. A. Maron, CBS Publishers & Distributors, 2000.
3. An Introduction to the Theory of Numbers, Ivan Niven, Herbert S. Zuckerman, Hugh L. Montgomery, 2008.
4. The elements of coordinate geometry, S. L. Loney, London: Macmillan and Co., 1896.
5. Higher Engineering Mathematics,B. S. Grewal, Khanna Publishers, 2012.

Course Learning Outcomes:

The course will enable the students to:

- Understand the definition of complex numbers and distinguish between real and imaginary parts, sequences, and series.
- Apply the fundamental principle of counting, permutations, and combinations.
- Understand and apply properties of matrices and determinants, and solve linear equation systems using a matrix's inverse.
- Understand the cartesian system and analyze parallel and perpendicular lines, intercepts of a line, and angles between two lines.

These outcomes will equip students with a comprehensive understanding of each topic and the ability to solve related mathematical problems effectively.

Syllabus

CCT-51T- BSC-104-Genetics

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
I	CCT-51T-BSC-104	Genetics				02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	BSC	02	-	02	30 Lectures, including diagnostic and formative assessments	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		1. Understand the principles of Mendelian genetics and their applications. 2. Explore deviations from Mendelian inheritance, including multiple alleles and gene interactions. 3. Study the mechanisms of sex determination, linkage, and recombination. 4. Analyze genetic diseases, pedigree analysis, and population genetics.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-51T-BSC-104–Genetics	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-51T-BSC-104-Genetics

Unit – I

Mendelian Genetics

- Pre-Mendelian genetic concepts; Concepts of Phenotype and Genotype
- Mendelian experiments on pea plants - Principle of Dominance, segregation, independent assortment
- Monohybrid and Dihybrid Cross, Back cross and Test cross

Multiple Alleles

- Deviations from Mendelism - Incomplete inheritance and Codominance;
- Pleiotropic genes, Multiple alleles, ABO blood groups and Rh factor in Human
- Interaction of genes: Epistasis, complimentary gene, Supplementary gene, duplicate gene

. (8 Lectures)

Unit-II

Sex Determination and Sex-Linked Characteristics

- Sex determination
- Sex linked characteristics
- X-linked color blindness; X-linked Haemophilia
- Dosage compensation

Linkage and recombination

- Concept of Linkage and Crossing over
- Recombination between two genes; recombination frequency
- Linkage Maps

(7 Lectures)

UNIT-III

Bacterial Genetics

- Transformation (Competent cells)
- Conjugation (Cointegrate Formation and Hfr Cells, Interrupted mating, Time–of–Entry Mapping, F' Plasmid)
- Transduction (Generalized transduction, Specialized Transduction)
- Use in gene mapping.

Chromosome structure

- Prokaryotic and eukaryotic chromosome
- Normal Human Karyotype
- extrachromosomal inheritance

- Chromosomal numerical (aneuploidy, euploidy) and structural (deletions, duplications, translocations and inversions) aberrations

(8 Lectures)

Unit-IV

Genetic Diseases and **Pedigree Analysis**

- Genetic diseases (Down syndrome, Klinefelter syndrome, Turner syndrome color blindness, Hemophilia and Phenylketonuria)
- Symbols used in pedigree studies
- Pedigree analysis for the inheritance pattern of genetic diseases

Population genetics

- Hardy-Weinberg principle
- Extension of H-W principle to multiple alleles and sex-linked alleles.
- Factors affecting Hardy Weinberg Equilibrium.

(7 Lectures)

Suggested Books and References

1. Lewin's Genes XII by Jocelyn E. Krebs, Elliott S. Goldstein, and Stephen T. Kilpatrick
2. Concepts of Genetics, 10th Edition by William S. Klug, Michael R. Cummings, and Michael A. Palladino
3. Genetics: Analysis and Principles, 5th Edition by Robert J. Brooker
4. Human Heredity: Principles and Issues by Michael R. Cummings
5. Principles of Genetics, 8th Edition by Eldon John Gardner
6. Principles of Genetics, 4th Edition by D. Peter Snustad and Michael J. Simmons (Wiley, 2005)
7. Genes IX, 9th Edition by Benjamin Lewin (Jones and Bartlett, 2007)
8. Modern Genetic Analysis by Anthony J.F. Griffiths et al. (Freeman)
9. Genes IX, 9th Edition by Benjamin Lewin (Jones and Bartlett, 2007)

Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]

1. https://onlinecourses.swayam2.ac.in/cec20_bt17/preview
2. https://nptel.ac.in/courses/102/104/102104052/
3. https://bio.libretexts.org/Bookshelves/Genetics/Online_Open_Genetics_(Nickle_and_Barrette-Ng)

Course Learning Outcomes:

After completing this course, the student will be able to:

1. Ability to explain Mendelian and non-Mendelian inheritance patterns.
2. Proficiency in analyzing sex-linked characteristics and chromosomal aberrations.
3. Understanding of bacterial genetics and its role in gene mapping.
4. Skills to perform pedigree analysis and apply the Hardy-Weinberg principle.

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Syllabus

CCT-51P-BSC-121-Physics Lab-I

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
I	CCT-51P-BSC-121	Physics Lab- I			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	BSC	-	02	02	60 Hours Practical	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		The objective of this course is to broaden their knowledge of physics concepts and principles, which can serve as a bridge between theory and practice.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Practical	CCT-51P-BSC-121– Physics Lab- I	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for **Physics Lab- I** should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-51T-BSC-121-Physics Lab-I

1. To study the damping of a compound pendulum and determine the Q of the oscillator including additional electromagnetic damping.
2. To find the M.I. of an unknown body using the Inertia Table.
3. To determine the modulus of rigidity of the wire using Maxwell's needle.
.4. To determine the Young's modulus Y of a beam by bending.
5. To verify the Newton's law of cooling.
6. To study the temperature variation of resistance and determine the temperature coefficient.
7. To determine the thermal conductivity of a given material.
8. To study interference phenomenon using a LASER source.
9. To determine the wavelength of sodium light by Newton's rings apparatus.
10. To determine the wavelength of spectral lines in Mercury light using a transmission grating.

Course Learning Outcomes:

By the end of this course, students will have developed strong fundamental skills in physics practical's, enabling them to design experiments, collect data and analyse results, which helps students to further understand the subject.

Syllabus

CCT-51P-BSC-122-Chemistry Lab-I

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
I	CCT-51P-BSC-122	Chemistry Lab- I			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	BSC	-	02	02	Practical's	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		1. To enable students to acquire a working skill in the laboratory that helps them to understand the basics of laboratory work related to various concepts of physical chemistry. 2. To impart an understanding of all the aspects of physical processes accompanied by chemical processes 3. To enable students to use of advanced methods instead of classical methods by making use of modern instruments in the determination and identification of the given chemical compound.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Practical	CCT-51P-BSC-122– Chemistry Lab- I	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for **Chemistry Lab- I** should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-51P-BSC-121-Chemistry Lab-I

Experiment No 1: Determination of surface tension by drop weight methodUsing stalagmometer method.

Experiment- 2: Determination of molecular weight of a given volatile organic liquid by using an ideal gas equation.

Experiment- 3: Determination of the relative viscosity of a given liquid by using an Ostwald viscometer.

Experiment- 4: Conductometric titration of Acetic acid with Sodium hydroxide.
(End-point determination during acid-base titration in the absence of indicator).

Experiment-5: Determination of solubility (the solubility of Benzoic acid in water at different temperatures) and heat of solution.

Experiment- 6: Determination of heat of solution of KNO_3/NH_4Cl. Application of the concepts of specific heat and temperature change in the determination of heat of solution of a water-soluble salt, KNO_3/NH_4Cl.

Experiment- 7: Determination of melting point of given chemical compound.
Application of the concepts of the process of melting of solids like naphthalene, benzoic acid and urea.

Experiment 8: Determination of boiling point of given liquid like methanol, ethanol and cyclohexane.

Experiment- 9: Sublimation of camphor and naphthalene

Experiment-10: Crystallization of phthalic acid and benzoic acid from hot water.

Suggested Books and References:

1. Physical Chemistry Laboratory Manual (An Interdisciplinary Approach) By Amritha Anand and Ramesh Kumari
2. Practical Physical chemistry by Alex Findlay.
3. Practical book of physical chemistry by A.B.Aher, B.O. Aher, J.P. Bapurao, P.A. Pathade and V.A. Bairagi.

Course Learning Outcomes:

The prescribed syllabus expects that the students would get exposure to various aspects of physical chemistry in the curriculum more contextually and systematically as they learn by doing.

The course will enable the students to:

- Learn about the basics of physical chemistry and its applications.
- Acquire knowledge about the various aspects of physical processes like melting, boiling etc.
- Understand the role of the concept of sublimation.
- Learn fundamental concepts responsible for surface tension and viscosity.
- This course will help in the development of their interest in research and innovations.

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Syllabus

CCT-51P- BSC-123-Life Sciences Lab

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
I	CCT-51P-BSC-123	Life Sciences Lab			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	BSC	-	02	02	60 Hours Practical's	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		1. Develop problem-solving skills related to monohybrid and dihybrid crosses. 2. Gain practical experience in conducting genetic tests and analyzing genetic traits. 3. Understand the application of the Hardy-Weinberg principle in population genetics.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Practical	CCT-51P-BSC-123–Life Sciences Lab	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for **Life Sciences Lab** should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-51P-BSC-123-Life Sciences Lab

1. Problems related to mono-hybrid and Dihybrid cross
2. Ishihara Test for colour blindness
3. Pedigree construction and analysis
4. Study of Barr body in the Buccal epithelial cells
5. Genetic diseases (Down syndrome, Klinefelter syndrome, Turner syndrome, Color blindness, Hemophilia and Phenylketonuria)
6. Problems based on Hardy-Weinberg principle
7. Qualitative test for carbohydrate content in food samples
8. Qualitative test for protein content in food samples
9. Qualitative test for lipids in food samples
10. Determine the beer- Lambert's law using copper sulphate solution
11. Determine the effect of temperature on enzyme activity
12. Determine the effect of PH on enzyme action

Course Learning Outcomes:

- Ability to solve genetic problems involving crosses and inheritance patterns.
- Proficiency in conducting and interpreting tests like the Ishihara Test and Barr body analysis.
- Capability to analyze pedigrees and understand the implications of genetic diseases.

Syllabus

CCT-51T-ESC-101-Programming in C

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
I	CCT-51T-ESC-101	Programming in C			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	ESC	02	-	02	30 hours of Lectures, including program development and formative assessments	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		1. To learn the detailedstep-by-step process of problem-solving using a computer 2. To gain an understanding of algorithms and flowchart 3. To develop the ability to writeprograms using the C language 4. To give the concept of data type, control flow, structured data type, functions etc.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-51T-ESC-101– Programming in C	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-51T-ESC-101-Programming in C

Unit – I

Introduction and Basic Concepts – Problem to Program process, Introduction to Algorithm, flowchart, History and importance of C, Basic structure of C program, execution of C program,C character set, Tokens, Variables, Data Types, Operators & Expressions, Input & Output Functions

(7 Lectures)

Unit – II

Control Structure - Decision Making and Branching: Introduction, Decision Making with if Statement; Simple if Statement, the if..else Statement, Nested if..else, The else..if Ladder, The Switch statement, The ? : Operator
Looping: Introduction, The while Statement, The do statement, The for statement, Jumping Statements (Break, Continue, goto)

(8 Lectures)

Unit – III

Array & String – One-dimensional Arrays, Reading & Writing of an array, basic array Operations, Example programs- Bubble sort, Selection sort, Linear search, Binary search, Two-dimensional Arrays, Declaration & Initialization of Two-dimensional Arrays, Example programs Multiplication, Strings: Declaring and Initializing String Variables, Reading & Writing of Strings, Arithmetic Operations on Characters, String-handling Functions, Example: sorting of string, string palindrome
Pointers: Introduction, Declaring Pointer Variables, Initialization & accessing a variable through Pointer, its uses

(8 Lectures)

Unit – IV

Functions: Definition of Functions, Syntax, Function Declaration & calling, parameter passing(call by value, call by reference), Category of Functions, Passing Arrays to Functions, Recursion, Storage classes,Command Line Argument
Structures & Union: Introduction, defining a structure & Union, difference between structure & Union, accessing structure members, structure initialization, array of structures
File Management in C: Introduction, Defining and opening a file, closing a file, Input/output and Error Handling on Files

(8 Lectures)

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Suggested Books and References –

1. **Programming in ANSI C,** Balaguruswamy E. (2019), 8th Edition, McGraw Hill Education
2. **Let Us C,**. Kanetkar Y.P.(2019), 16th Edition, BPB Publications
3. **Programming in C,** Dey P., GhoshM.,(2018), Oxford University Press
4. **The C Programming Language,** Kernighan B.W. and Dennis M. R.(2015), Pearson Education India
5. **Introduction to C Programming,** TharejaR.(2015) ,Oxford University Press

Suggested E-resources:

- **https://www.w3schools.com/c/c_intro.php**
- **https://www.programiz.com/c-programming/online-compiler/**

Course Learning Outcomes:

By the end of the Course, Students will be able to:

1. Describe the fundamentals of C programming Language.
2. Apply appropriate Control structures to solve problems.
3. Explain the concept of Arrays, Strings and pointers.
4. Write programs using structure, user-defined functions

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Syllabus

CCT-51T-ESC-102-Biochemistry

Semester	Code of the Course	Title of the Course/Paper			NHEQ F Level	Credits
I	CCT-51T- ESC-102	Biochemistry			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	ESC	02	-	02	30 Lectures, including program development and formative assessments	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		1. To understand the structure and function of biomolecules at a chemical level with a biological perspective. 2. To learn about the importance of water, bioenergetics and enzymes in living organisms. 3. To gain an understanding of the metabolic pathway of biomolecules. 4. To comprehend the biosynthetic pathway and interrelationship among biomolecules.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-51T-ESC-102– Biochemistry	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-51T-ESC-102-Biochemistry

UNIT-I

The Foundations of Biochemistry: Cellular Foundations, Chemical Foundations, Physical foundations, Genetic foundations and Evolutionary Foundations. Water: Weak interactions in aqueous systems, ionization of water, weak acids and Acid bases, Buffering against pH change.

. **(7 Lectures)**

UNIT-II

Biomolecules structure & Function: Amino Acids: Structure, Essential and non-essential types, characteristics, Lambert-Beer's law. Protein: Peptides & proteins, Primary structure, secondary structure, tertiary & quaternary structure, three-dimensional structure of proteins. Carbohydrates: Monosaccharides, disaccharides & polysaccharides. Lipids: Storage lipids, structural lipids.

(8 Lectures)

UNIT-III

Bioenergetics & Enzymes: Principles of Bioenergetics: Bioenergetics & thermodynamics. Enzymes: introduction, Kinetics, Michalis-Menten Equation, Regulatory enzymes, Examples of enzymatic reactions.

(7 Lectures)

UNIT-IV

Metabolism & Biosynthesis: Glycolysis Pathway, fate of pyruvate, Citric Acid Cycle, Acetyl CoA, reactions of Citric Acid cycle. Carbohydrate Biosynthesis in Plants: C3, biosynthesis of starch. Lipid Biosynthesis: Biosynthesis of fatty acids, triacylglycerols. Nitrogen metabolism.

(8 Lectures)

Suggested Books and References:

1. **Biochemistry**, Berg J.M., Tymoczko J.L. and Stryer L. (2011), 7th edition W.H. Freeman and Co. New York.
2. **Principles of Biochemistry**, Nelson, D. C. and Cox, M.M., Lehninger. (2010), 5th edition, W.H. Freeman and Co.
3. **Biochemistry,** Voet D. and Voet J.D. (2011), 3rd edition, John Wiley and Sons.

Course Learning Outcomes:

By the end of the Course, Students will be able to:

1. Understand fundamental concepts of biochemistry.
2. Apply basic principles of chemistry to biological systems and molecular biology.
3. Correlate various physiological and metabolic events.
4. Better understand the chemical reactions at a molecular level to develop new ways to harness these.
5. Learn the nature and importance of enzymes in living systems
6. Gain insight into the thermodynamics and role of ATP.

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Syllabus

CCT-51T- ESC-103: Basic Psychological Processes

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
I	CCT-51T-ESC-103	Basic Psychological Processes			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	ESC	02	-	02	30 Lectures, including diagnostic and formative assessments	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		1. To understand the meaning, goals, history and different methods of psychology. 2. To gain an understanding of the meaning, nature and principles of attention, sensation and perception. 3. To learn about the meaning, nature, types and theories of motivation and emotion. 4. To comprehend the definition, types, theories and assessment methods of personality.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-51T-ESC-103– Basic Psychological Processes	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-51T-ESC-103-Basic Psychological Processes

Unit – I

Introduction: Definition and Goals of Psychology; Schools of Psychology-Structuralism, Functionalism, Behaviorism, Gestalt and Psychoanalysis; Modern Perspectives-Biological, Psychodynamic, Behavioral, Cognitive, Humanistic, Evolutionary, and Socio-cultural; Methods-Observation, Case Study, Survey and Experimental Method.

(9 Lectures)

Unit – II

Attention, Sensation and Perception: Attention-Meaning and Nature;Sensation-Meaning, Sensory Receptors, Sensory Thresholds, Habituation and Sensory Adaption. Perception-Meaning, Constancies-Size, Shape and Brightness, Gestalt Principles, Factors Influencing Perception.

(7 Lectures)

Unit – III

Motivation and Emotion: Motivation: Meaning and Approaches-Instinct, Drive-Reduction, Arousal, Incentive and Humanistic. Emotion: Elements-Physiology, Expression, and Subjective Experience; Theories-Cannon Bard, James Lange, Schachter – Singer, Opponent-Process Theory.

(8 Lectures)

Unit – IV

Personality: Definition; Type Theories- Sheldon, Kretchmer, and Jung; Trait Theories-Allport, Cattell, McCrae, and Costa; Personality Assessment- Self-report Inventories, Projective Tests and Behavioral Assessments.

(6 Lectures)

Suggested Books and References:

1. **Psychology**, Baron, R.A. & Misra, G. (2016)., New Delhi: Pearson Education India.
2. **Psychology,** Ciccarelli, S.K., White, J.N. & Misra, G. (2022). New Delhi: Pearson Education
3. **Introduction to Psychology**, Okon, Abigail Edem (2019), University of Calabar.
4. **Introduction to Psychology**, Morgan, C.T., King, R.A., &Schopler, J. (2004) New Delhi: Tata McGraw Hill.
5. **Understanding Psychology**, Kalat, J.W. (2016). New York: Cengage Learning

Course Learning Outcomes:

By the end of the Course, Students will be able to:

1. Develop an understanding of the epistemology of psychology and analyze and appreciate psychology as a science and its biological basis.
2. Analyze and understand the concepts of sensation, attention and perception and their role in day-to-day life.
3. Apply the principles of major concepts of psychology such as motivation and emotion.
4. Develop an understanding of different theories and methods to study personality.

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Syllabus

CCT-51P-ESC-121-Programming in C Lab

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
I	CCT-51P-ESC-121	Programming in C Lab			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	ESC	-	02	02	60 Hours Practical	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		The objectives of this course are to gain hands-on experience in writing, debugging, and optimizing C programs and to develop problem-solving skills through programming in C.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Practical	CCT-51P-ESC-121– Programming in C Lab	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for **Programming in C Lab** should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

Detailed Syllabus

CCT-51P-ESC-121-Programming in C Lab

1. Writing and running the basic C-programs and learning about debugging.
2. Write the C- programs with implementing conditional statements (if, else, switch).
3. Write the C-programs for the implementation of loops (for, while, do-while).
4. Write the C-programs based on recursion.
5. Write C-programs to implement sorting algorithms.
6. Write the C-programs for matrix addition, subtraction and multiplication.
7. Write the C-programs to implement the concept of strings and manipulate the strings.
8. Write the C-programs to implement the user-defined functions.
9. Write the C-programs about the implementation of pointers.
10. Write programs in C for implementation of file handling.

Suggested Books and References:

1. How to Program C, Paul Deitel and Harvey Deitel (Pearson Education Asia)
2. Programming in ANSI C, E Balaguruswamy (Tata McGraw Hill).

Course Learning Outcomes:

By the end of this course, students will have developed strong foundational skills in C programming, enabling them to write, debug, and optimize efficient code for a variety of applications. They will also be proficient in implementing loops, arrays, pointers and file handling.

CCT-51F-MC-101-Anandam-I

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
I	CCT-51F-MC-101	Anandam-I			5	00
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	MC	-	00	00	60 Hours Field Activity	
Objectives of the Course:		Students are expected to engage in – 1. An individual act of goodness, caring, sharing and giving (time and energy) every day 2. Group activity – a project in service of the local community (Group Community Service Project) 3. 3. Apply their knowledge and skills to solve specific community problem 4. Learn to plan, lead and organise community events. 5. Have a sense of belonging to their college campus and community and find something they are interested in doing in their free time. 6. Make new friends, expand social network, and boost social skills and mental health. 7. Be useful to society as it will protect them against stress, frustration and depression				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Practical	CCT-51F-MC-101–Anandam-I	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

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SEMESTER-WISE PAPER TITLES WITH DETAILS

DD0401 – Dual Degree B.Tech.-M.Tech. in Converging Technologies II-Semester							
#	Semester	Type	Title	Credits			
				L	T	P	Total
1.	II	HSMC	CCT-52T- HSMC-102– Scientific Writing	2	0	0	2
2.	II	BSC	CCT-52T-BSC-105–Physics-II	2	0	0	2
3.	II	BSC	CCT-52T-BSC-106-Chemistry-II	2	0	0	2
4.	II	BSC	CCT-52T-BSC-107-Mathematics-II	2	0	0	2
5.	II	BSC	CCT-52T-BSC-108-Cell Biology	2	0	0	2
6.	II	BSC	CCT-52P-BSC-124-Physics Lab - II	0	0	2	2
7.	II	BSC	CCT-52P-BSC-125-Chemistry Lab -II	0	0	2	2
8.	II	ESC	CCT-52P-BSC-126-Cell Biology Lab	0	0	2	2
9.	II	ESC	CCT-52T-ESC-104- Semiconductor Electronics Devices and Applications	2	0	0	2
10.	II	ESC	CCT-52T-ESC-105- Object Oriented Programming	2	0	0	2
11.	II	ESC	CCT-52P-ESC-122- Semiconductor Electronics Lab	0	0	2	2
12.	II	ESC	CCT-52P-ESC-123-C++ Programming Lab	0	0	2	2
13.	II	MC	CCT-52T-MC-102-Environmental Studies	0	0	0	0
				14	**0**	**10**	**24**

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Syllabus

CCT-52T-HSMC-102-SCIENTIFIC WRITING

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
II	CCT-52T-HSMC-102	Scientific Writing			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	HSMC	02	-	02	Lectures	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		1. To understand the importance of writing scientifically. 2. To develop the skill of writing for different writing purposes. 3. To acquire the ability to review the available literature				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-52T- HSMC-102– Scientific Writing	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks
Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-52T-HSMC-102-SCIENTIFIC WRITING

UNIT-I

Importance and Overview of Scientific Writing

a. Dissertation

b. Research Article/ Scientific paper
c. Review paper
d. Reports

UNIT-II

Components of Scientific Writing

a. Title
b. Abstract
c. Introduction, Rationale and Objectives

d. Review of Literature
e. Methods and Materials

f. Results and Discussion
    i. Writing text with discussion
    ii. Table, Flowcharts, with titles and footnotes
    iii. Graph, diagrams

g. Summary and Conclusion
h. Limitations, Recommendations and Future Scope
i. Bibliography/ References - Different types of writing styles: APA, MLA, Chicago
j. Appendices

UNIT-III

Writing and presenting a research proposal for grants:

a. Introduction/ Background information

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b. Rationale and Importance
c. Pilot study
d. Research proposal
e. Time-frame
f. Outcomes of the study and its implications
g. Budgeting
h. Summary and Conclusions

UNIT-IV

Ethics in Scientific Writing

a. Ethical approval for research
b. Plagiarism in writing and how to avoid it
c. Authorship, conflict of interest
d. Confidentiality in data handling and reporting
e. Responding to comments by reviewer

Suggested Books and References:

1. Hoffman AH. Scientific Writing and Communication: Papers, proposals and presentations (4th edition; 2019). Oxford University Press.
2. Alley M. The Craft of Scientific Writing (4th Edition). Springer.
3. APA, Publication Manual of American Psychological Association, 3rd Edition, Washington, 1984.
4. Cooper HM. Integrating research, A guide for literature review, 2nd Edition, Sage publications, California, 1989.
5. 3. Dunn FV and others, Disseminating Research: Changing profile. Sage Publications, 1994.

Course Learning Outcomes:

- This course will enable the students to develop the ability to write scientific documents like papers for publication, reports and other documents.
- It will also help them to understand the methods of presenting the data and results of the research.
- It will also make the student aware of ethics in research.

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Syllabus

CCT-52T-BSC-102-Physics-II

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
II	CCT-52T-BSC-105	Physics -II			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	BSC	02	-	02	Lectures	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		The objectives of this course are to provide the fundamental concepts of electromagnetism to the students and to develop a strong foundation in the principles of electromagnetics and their applications in engineering.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-52T-BSC-105– Physics-II	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks
Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-52T-BSC-105-Physics-II

Unit-I

Electric Field and potential due to discrete and continuous charge distribution, Electric Field Lines and Flux, Electrostatic energy, Gauss's Law and its Applications, divergence and Gauss divergence theorem, Electric Dipole and Energy Density

[7 Lectures]

Unit-II

Magnetic Forces on Moving Charges, The Biot-Savart Law, Ampère's Law, Magnetic Dipole Moments, Faraday's Law of Induction, Lenz's Law, Inductance and Energy in Magnetic Fields, Magnetic Force on a Current Element, Magnetization and Magnetic Materials, Magnetic Boundary Conditions

[8 Lectures]

Unit-III

Conductors in Electrostatic Equilibrium, field determination by method of image, Polarization in Dielectrics, Boundary Conditions for Dielectric Materials, Capacitance and Energy Storage in Capacitors, Magnetic Circuits, Inductance and Energy Stored in Magnetic Fields

[7 Lectures]

Unit-IV

Electromotive Force (EMF), Lenz's Law, Induced EMF and Inductance, Displacement CurrentDisplacement Current and Continuity Equation, Maxwell's equations in free space, Poynting Theorem and Energy Considerations, wave polarization

[8 Lectures]

Suggested Books and References:

1. W. H. Hayt and J. A. Buck, Engineering Electromagnetics, Tata McFraw Hill Education Pvt. Ltd, 2006.
2. Grifiths. D. J, Introduction to Electrodynamics, Prentice Hall, 2007.
3. Purcell. E.M, Electricity and Magnetism Berkley Physics Course, V2, Tata McGraw Hill, 2008.
4. Matthew N.O. Sadiku: Elements of Electromagnetics, Oxford Univ. Press.

Course Learning Outcomes:

By the end of this course, students will be able to apply fundamental principles of electromagnetics to analyze and solve problems involving electric and magnetic fields. They will understand and utilize Maxwell's equations and related concepts such as Gauss's Law, Faraday's Law, and the Biot-Savart Law in both theoretical and practical contexts.

Syllabus

CCT-52T-BSC-106-Chemistry - II

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
II	CCT-52T-BSC-106	Chemistry -II			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	BSC	02	-	02	30 hours Lectures	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		The objective of this paper is to enable students to acquire a skill set that helps them to understand the basics of Organic and Inorganic chemistry. The course aims to impart an understanding of all the aspects of Organic and Inorganic chemistry e.g. bonding and delocalization, stereochemistry, mechanism of organic reactions and reagents with polymer and supramolecular chemistry.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-52T-BSC-106–Chemistry-II	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks
Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-52T-BSC-106-Chemistry-II

Unit-I

Basics of general organic Chemistry

Inductive effect, hyperconjugation, electromeric and resonance effects, tautomerism(difference from resonance), aromaticity, Huckel's rule$(4n+2)\pi$.

Homolytic and heterolytic fission, types of reagents(electrophiles and nucleophiles), reactive intermediates (carbocations, carbanions, free radicals, carbene, nitrene and arynes), formal charge.

(8Lectures)

Unit-II

Stereochemistry

Fischer, newman and sawhorse projection formula and their interconversion.

Geometrical isomerism: syn-anti, E/Z-nomenclature, configuration of oximes and alicyclic compounds.

Optical isomerism: optical activity, elements of symmetry, stereogenic centre, enantiomers, R/S- nomenclature, prochirality: homotopic and heterotopic ligands and faces, molecules with two chiral centres, diastereomers, racemic mixture, resolution, inversion and retention.

(7Lectures)

Unit-III

Mechanism of organic reaction and some important reagents

Type of organic reactions and their mechanisms-substitution: free radical, Aliphatic substitution (S_N1,S_N2 &S_Ni), & aromatic electrophilic substitution(activating and deactivating groups and directive influence), addition reaction: electrophilic addition reaction, free radical addition reactions of C=C, Elimination reaction(E1 and E2).

Aceto acetic ester, Malonic ester, Grignard reagent.

(8Lectures)

Unit-IV

Polymer fundamentals

Organic polymers: addition and condensation polymers, their mechanism, Zeigler-natta catalyst, thermosetting and thermoplastic polymers, other polymers:vinyl polymers, polyacrylonitriles, Bakelite and nylon.

Supramolecular chemistry

supramolecular host-guest interactions, macrocyclic effect.

(7Lectures)

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Suggested Books and References:

1. Principles, structures and reactivity; J.E. Huheey, E.A.Keiter, R.L. Keiter & O.K. Medhi; pearson publication.
2. Reaction mechanism in organic chemistry by Mukherjee & Singh.
3. Stereochemistry, conformation and mechanism by P.S.Kalsi(7^{th} edition).
4. Concise inorganic chemistry by J.D.Lee, ELBS.
5. Advanced inorganic chemistry by F.A.Cotton, G.Wilkinson, C.A. Murillo &M.Bochmann

Course Learning Outcomes:

The prescribed syllabus expects that the students would get exposure to various aspects of organic and inorganic chemistry in the curriculum more contextually and systematically as they study its various units.

The course will enable the students to:

- Learn about the basics of organic reactions and their mechanisms.
- Acquire knowledge about the various aspects of polymer chemistry.
- Understand the role of organic reagents in organic synthesis.
- Learn fundamental concepts of supramolecular chemistry.

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Syllabus

CCT-52T-BSC-107-Mathematics-II

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
II	CCT-52T-BSC-107	MATHEMATICS-II			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	BSC	02	-	02	Lectures (Thirty)	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		To develop a deep understanding of calculus concepts and their applications in solving real-world problems.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-52T-BSC-107– Mathematics-II	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks
Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-52T-BSC-107-Mathematics-II

UNIT-I

Limits and Continuity: Definition, Rate of Change, Limit, Functions of one variable, function of a function, Rules of finding Limits (simple problems), Continuity, simple examples of discontinuous functions.

(7 Lectures)

UNIT-II

Derivatives: Definition, Differentiability, Differentiation by abridged method (simple algebraic and trigonometrical functions), Differentiation rules (sum, difference, product, division of two functions), Partial differentiation of functions of one or two variables.

(8 Lectures)

UNIT-III

Applications of Derivatives: Mean value theorem, Rolle's, Cauchy and Lagrange's theorems, maxima and minima of one variable, indeterminate form: L-Hospital rule, Euler's formula.

(8 Lectures)

UNIT-IV

Integration: integral as the converse of differentiation, indefinite integral, integration by substitution, integration of the product of two functions, definite integrals, properties and problems, substitution in definite integrals.

(7 Lectures)

SuggestedBooksandReferences:

1. Calculus by Thomas and Finny, Pearson Education Asia, 1999
2. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley India Pvt. Ltd., 10th Edition, 2011.
3. Calculus: Early Transcendentals by James Stewart, Cengage Learning, 8th Edition, 2015.
4. Thomas' Calculus by George B. Thomas Jr., Maurice D. Weir, Joel R. Hass, Pearson Education, 14th Edition, 2018.
5. Differential and Integral Calculus by Richard Courant, Wiley, 2nd Edition, 1988.
6. A Course in Calculus and Real Analysis by Sudhir R. Ghorpade, Balmohan V.

Limaye, Springer, 1st Edition, 2006.

CourseLearningOutcomes

Thecoursewillenablethestudents to:

- Define key concepts related to limits and continuity, such as rate of change, limit, and types of discontinuities in functions.
- Explain the rules for finding limits and the concept of continuity in mathematical functions.
- Apply the rules of finding limits to solve simple problems involving functions of one variable and functions of a function.
- Analyze different types of discontinuities in functions and determine the points at which functions are not continuous.
- Evaluate limits and determine the continuity of given functions using appropriate rules and methods.

Theseoutcomeswill equipstudentswithacomprehensiveunderstandingofeach topicandtheabilitytosolverelatedmathematicalproblems effectively.

Syllabus

CCT-52T-BSC-108-Cell Biology

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
II	CCT-52T-BSC-108	Cell Biology			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	BSC	02	-	02	30 Lectures,	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		1. To understand the basic architecture and function of cell and cell organelles. 2. To learn about the composition, organization and function of biomembranes in living organisms. 3. To gain an understanding of the membrane trafficking of proteins in membranes and organelles. 4. To comprehend the role of cyclins and checkpoints in the regulation of cell cycle and cell growth.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-52T-BSC-108–Cell Biology	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A**&**B**.

PART-A: 8 Marks
Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-52T-BSC-108-Cell Biology

UNIT-I

Cells: Introduction & Architecture: Introduction of cells, Organelles of eukaryotic cell: Endoplasmic reticulum, Golgi complex, Plant Vacuoles, Nucleus, Mitochondria, Chloroplasts, Ribosomes, Cytoskeleton: 3 types of filaments, organization, microfilaments, intermediate filaments, microtubules.

. **(7 Lectures)**

UNIT-II

Bio membrane: Structure & Transport: Bio membrane: Composition, organization, Basic function, Overview of Membrane transport, Diffusion: passive diffusion, Active diffusion, membrane proteins mediated transport, Different classes of pumps (ATP powered pumps, Na-/H+ ATPase, Muscle Ca+ ATPase), Co-transport (anti porter and symporter).

(7 Lectures)

UNIT-III

Membrane Trafficking: Moving proteins into membranes and organelles, Translocation of secretory proteins across the ER membranes, insertion, folding and quality control of proteins in ER, Sorting of proteins to mitochondria, Vesicular traffic, Molecular mechanisın of vesicular trafficking.

(7 Lectures)

UNIT-IV

Cell Cycle and Cell Growth Control: Overview of cell cycle, Cell cycle control in mammalian cells: Go, G1, G2, S phase, Checkpoints, Cyclins, cell division: Mitosis, Meiosis, Programmed cell death through apoptosis, Failure of cell cycle checkpoints, Role of p53, Genetic basis of cancer.

(9 Lectures)

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Suggested Books and References –

1. **Molecular Cell Biology**, Lodish H., Berk A., Matsudaira P., Chris A., Kaiser V., Krieger M., Scott M.P., Zipursky L., and Darnell J., (2003) 5th edition. WH Freeman Publication.
2. **The Cell: A Molecular Approach**, Cooper, G.M. and Hausman, R.E., (2009), 7th edition, ASM Press & Sunderland (Washington DC), Sinauer Associates, MA.
3. **Cell and Molecular Biology: Concepts and Experiments,** Karp, G. (2010), 6th Edition. John Wiley & Sons. Inc.

Course Learning Outcomes:

By the end of the Course, Students will be able to:

1. Understand fundamental concepts of cells.
2. Better understand the structure and function of various cell organelles in a eukaryotic cell.
3. Learn the structure and function of biomembranes in living systems.
4. Gain insight into membrane trafficking of proteins in cells.
5. Acquire knowledge about the cell cycle and cell growth regulation in cells.
6. Learn the cell division processes of Mitosis and Meiosis.
7. Understand the role of P53 protein in Cancer.

Syllabus

CCT-52P-BSC-124-Physics Lab-II

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
II	CCT-52P-BSC-124	Physics Lab- II			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	BSC	-	02	02	Practical's	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		The course aims to provide students with hands-on experience in fundamental and advanced concepts of physics, enabling them to apply theoretical knowledge to real-world scenarios.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-52P-BSC-124–Physics Lab-II	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for **Physics Lab-II** should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-52P-BSC-124-Physics Lab-II

1. To study electromagnetic induction and to verify Faraday's law.
2. Explore Lenz's Law by studying the direction of induced EMF in a coil when a magnetic field changes.
3. Comparison of electromotive forces of two cells using the potentiometer.
4. Verify the Biot-Savart Law by measuring the magnetic field at different distances from a current-carrying conductor.
5. Determination of e/m of electron by Thomson's method.
6. Determine the self-inductance of a coil by Anderson's bridge method.
7. To determine the specific resistance of the material of a wire and to determine the difference between two small resistances using Carey Foster's bridge.
8. Measure the capacitance of a capacitor and determine the dielectric constant of materials.
9. To study the variation of the magnetic field due to a current carrying circular coil along its axis.
10. Study of excitation of normal modes and frequency splitting measurements using a coupled oscillator.

Course Learning Outcomes:

These practicals provide a comprehensive hands-on experience, reinforcing the key concepts of electromagnetism and preparing students for advanced study or professional application in this field.

Syllabus

CCT-52P-BSC-125-Chemistry Lab- II

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
II	CCT-52P-BSC-125	Chemistry Lab- II			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	BSC	-	02	02	Practical's	
Objectives of the Course:		The objective of this paper is to enable students to acquire a working skill in the laboratory that helps them understand the basics of laboratory work related to various concepts of Organic chemistry & inorganic chemistry. The course aims to impart an understanding of all the aspects of organic and inorganic processes accompanied by chemical processes.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-52P-BSC-125– Chemistry Lab-II	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for **Chemistry Lab-II** should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-52P-BSC-125-Chemistry Lab- II

Experiment-1: Determination of one functional group in a given compound.
Experiment-2: Determination of two functional groups in a given compound.
Experiment-3: Estimation of hardness of water by EDTA.
Experiment-4: Estimation of copper by using thiosulphate by the iodometric method.
Experiment-5: Determination of alkali content in antacid tablet by using HCl.
Experiment-6: Determination of acetic acid in commercial vinegar using NaOH.
Experiment-7: Estimation of Ferrous and ferric by dichromate/permanganate method.
Experiment-8: Estimation of Calcium content in chalk as calcium oxalate by permangnometry.
Experiment-9: To study reaction kinetics of decomposition of H_2O_2 by iodide.
Experiment-10 : Determine the specific rate of reaction of the hydrolysis of ethyl acetate catalyzed by hydrogen ions at room temperatures.

Suggested Books and References–

1. Laboratory Manual ofOrganic Chemistry by Raj K Bansal
2. Advanced practical physical chemistry by N K Vishnoi**.**
3. Organic lab manual by S K Sinha.
4. Inorganic lab manual by S. Mumazuddin& S K Sinha.

Course Learning Outcomes:

The prescribed syllabus expects the students would get exposure to various aspects of physical chemistry in the curriculum more contextually and systematically as they learn by doing.
The course will enable the students to:

- Learn about the basics of organic and inorganic chemistry and its applications.
- Acquire knowledge about the various aspects of organic processes
- Understand the role of the concept of decomposition and hydrolysis.
- Learn fundamental concepts responsible for functional group detection.
- This course will help in the development of their research interest.

Syllabus

CCT-52P-BSC-126-Cell Biology Lab

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
II	CCT-52P-BSC-126	Cell Biology Lab			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	BSC	00	02	02	60 hours practical	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		1. To learn & develop skills and hands-on training in the basics of cell biology. 2. To understand various cellular and sub-cellular components. 3. To develop a systematic approach towards the organization and composition of biomembranes as well as histochemical localization of biomolecules in cells. 4. To gain an understanding of the various cell stages of mitosis and meiosis in specimens. 5. To emphasize on the use of advanced methods instead of classical methods in experiments.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-52P-BSC-125– Cell Biology Lab	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for **Cell Biology Lab** should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-52P-BSC-126-Cell Biology Lab

1. Study of electron microphotographs of various cell organelles.
2. Study of plant cell structure from Onion.
3. Study of animal cell structure from cheek cells.
4. Study of electron microphotographs of viruses, bacteria and eukaryotic cells for comparative study of cellular organization.
5. Study of plastid for pigment distribution in Tomato, Cassia and Capsicum.
6. Study of divisional stages in mitosis from onion root tips.
7. Study of divisional stages in meiosis in grasshopper testes/onion or Rhoeo flower buds.
8. Effect of temperature on membrane permeability of beetroot.
9. Effect of different solvents on membrane permeability of beetroot
10. Histochemical localization of protein, carbohydrate, fats, starch and lignin.
11. Any other practical based on the theory syllabus.

Suggested Books and References:

1. **Cell Biology: Laboratory Manual:**Ledbetter,M.L. (1993),. 2nd Edition, RonJon Publishing. Inc.
2. **Cell and Molecular Biology Lab. Manual:** Thompson, D.A. (2011),Createspace Independent Publishing Platform.
3. **Cell Biology Practical Manual:**Toteja,R., Gupta, R., Makhija, S. (2018), Prestige Publishers.

Course Learning Outcomes:

By the end of the Course, Students will be able to:

1. Develop working skills in cell biology that will be helpful further in research and innovations.
2. Better understanding the various cell forms and cell organelles in living systems.
3. Learn the structure and function of biomembranes in living systems.
4. Gain insight into various plastid distributions in plant cells.
5. Acquire knowledge about the histochemical localization of protein, carbohydrate, fats, starch and lignin.
6. Learn the cell division processes of Mitosis and Meiosis.

Syllabus

CCT-52T-ESC-126-Semiconductor Electronics Devices and Applications

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
II	CCT-52T-ESC-104	Semiconductor Electronics Devices and Applications			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	ESC	02	-	02	30 Lectures, including program development and formative assessments	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		The course aims to provide students with foundational knowledge in electronics, focusing on circuit analysis, semiconductor devices, amplifiers, and oscillators. Students will understand the principles and applications of electronic components and circuits, preparing them for more advanced studies and practical work in electronics.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-52T-BSC-108–Cell Biology	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks
Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-52T-ESC-104-Semiconductor Electronics Devices and Applications

UNIT-I

Electric Network and PN junction

Electric Networks: Introduction to DC and AC circuit analysis using Kirchhoff's Laws. Understanding loop and nodal equations.

P-N Junction Diode: Understanding charge carriers, drift, and diffusion processes. The P-N junction diode equation, and the effects of capacitance.

(7 Lectures)

Unit-II

Semiconductor Devices and Rectifiers

Rectifiers and Filters: Half-wave, full-wave, and bridge rectifiers. Ripple factor, efficiency, and voltage regulation. Introduction to filters: Series inductor, shunt capacitor, L-section, and π-section filters.

Zener Diode Voltage Regulation: Working principles of Zener diodes in voltage regulation. Introduction to voltage multipliers.

(8 Lectures)

Unit-III

Transistor Fundamentals and Biasing

Transistor Basics: Operation and characteristic curves of Bipolar Junction Transistors (BJTs). Understanding the concept of the load line and operating point.

Transistor Configurations: Common Base (CB), Common Emitter (CE), and Common Collector (CC) configurations.

(8 Lectures)

Unit-IV

Amplifiers and Oscillators

Amplifiers: Introduction to transistor amplifiers using hybrid parameters. Concepts of positive and negative feedback in amplifiers.

Oscillators: Principles of oscillation, feedback concept, and Barkhausen criterion for sustained oscillations. Study of different types of oscillators: RC and LC Oscillators.

(8 Lectures)

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Suggested Books and References:

1. Basic Electronics and Linear Circuits by N.N. Bhargava, D.C. Kulshreshtha, S.C. Gupta.
2. Solid State Electronic Devices by Ben G. Streetman and Sanjay Kumar Banerjee.
2. "Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky
3. "Microelectronic Circuits" by Adel S. Sedra and Kenneth C. Smith
4. "Solid State Electronic Devices" by Ben G. Streetman and Sanjay Kumar Banerjee
5. "The Art of Electronics" by Paul Horowitz and Winfield Hill
6. "Electronic Principles" by Albert Malvino and David Bates
7. "Electronic Devices and Circuits" by David A. Bell
8. "Basic Electronics for Scientists and Engineers" by Dennis L. Eggleston
9. "Foundations of Analog and Digital Electronic Circuits" by Anant Agarwal and Jeffrey H. Lang
10. "Electronic Instrumentation and Measurements" by David A. Bell

Course Learning Outcomes:

Upon completion of the course, students will be able to verify and apply Kirchhoff's laws in practical circuits, analyze and interpret the characteristics of various semiconductor devices, and measure and evaluate properties like band gap and temperature dependence in semiconductors. They will also gain the ability to design and assess rectifier circuits, voltage regulators, and oscillators, while understanding the role of feedback in amplifiers to enhance circuit performance. These skills will equip students to tackle real-world electronic design challenges effectively.

Syllabus

CCT-52P-ESC-122-Semiconductor Electronics Lab

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
II	CCT-52P-ESC-122	Semiconductor Electronics Lab			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	ESC	-	02	02	60 Hours practical's	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		This course aims to provide practical understanding and hands-on experience in fundamental electronics concepts, including circuit analysis, semiconductor device characteristics, and oscillator design. Students will develop the ability to design, build, and analyze electronic circuits, enhancing their problem-solving skills and preparing them for advanced studies in electronics.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-52P-ESC-122– Semiconductor Electronics Lab	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for the **Semiconductor Electronics Lab** should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-52P-ESC-122-Semiconductor Electronics Lab

1. Verify Kirchhoff's laws using breadboard circuits with resistors and voltage sources.
2. Study the characteristics of a given transistor (PNP/NPN) in common emitter, common base, and common collector configurations.
3. Determine the band gap of a semiconductor using a junction diode.
4. Study the temperature dependence of resistance in a semiconductor using the four-probe method.
5. Study the characteristics of a junction diode and a Zener diode.
6. Study the characteristics of a field effect transistor (FET) and design an amplifier with finite gain.
7. Study a power supply using two diodes or a bridge rectifier with various filter circuits.
8. Study a half-wave rectifier using a single diode and apply L and π section filters.
9. Design a Zener-regulated power supply and study the regulation with various loads.
10. Study the frequency response of a transistor amplifier and obtain the input and output impedance.
11. Design and study an R-C phase shift oscillator and measure the output impedance (frequency response with change of R and C components).
12. Study a voltage multiplier circuit to generate high voltage D.C. from A.C.
13. Design a Hartley oscillator and study its frequency stability and waveform.
14. Design a Colpitts oscillator and evaluate its performance.
15. Investigate the effect of negative feedback on amplifier performance.

Suggested Books and References:

1. "Electronic Devices and Circuit Theory" by Robert L. Boylestad and Louis Nashelsky
2. "Microelectronic Circuits" by Adel S. Sedra and Kenneth C. Smith
3. "Solid State Electronic Devices" by Ben G. Streetman and Sanjay Kumar Banerjee
4. "The Art of Electronics" by Paul Horowitz and Winfield Hill
5. "Electronic Principles" by Albert Malvino and David Bates
6. "Electronic Devices and Circuits" by David A. Bell
7. "Basic Electronics for Scientists and Engineers" by Dennis L. Eggleston
8. "Foundations of Analog and Digital Electronic Circuits" by Anant Agarwal and Jeffrey H. Lang
9. "Electronic Instrumentation and Measurements" by David A. Bell

Course Learning Outcomes:

Upon completion of the course, students will be able to verify and apply Kirchhoff's laws in practical circuits, analyze and interpret the characteristics of various semiconductor devices, and measure and evaluate properties like band gap and temperature dependence in semiconductors. They will also gain the ability to design and assess rectifier circuits, voltage

regulators, and oscillators while understanding the role of feedback in amplifiers to enhance circuit performance. These skills will equip students to tackle real-world electronic design challenges effectively.

Syllabus

CCT-52T-ESC-105-Object Oriented ProgrammingMethodology

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
II	CCT-52T-ESC-105	Object-Oriented ProgrammingMethodology			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	ESC	02	-	02	30 Lectures, including program development	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		1. Introduces Object Oriented Programming concepts using the C++ language. 2. Introduces the principles of data abstraction, inheritance and polymorphism; 3. Introduces the principles of virtual functions and polymorphism 4. Introduces handling formatted I/O and unformatted I/O 5. Introduces exception handling				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-52T-ESC-105–Object-Oriented ProgrammingMethodology	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A**&**B**.

PART-A: 8 Marks
Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.
PART-B: 32 Marks

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Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-52T-ESC-105-Object Oriented ProgrammingMethodology

UNIT-I

Principles of Object-Oriented Programming (OOP), A Look at Procedure Oriented Programming, OOP Paradigm, Basic Concepts of OOP, Benefits of OPP, Application of OOP.

Introduction to C++: What is C++, A simple C++ Program, Structure of C++ Program. Tokens, Expression and controls Structures, Keywords, Identifiers and Constants, C++ data types, Variables: Declaration, Dynamic initialization of variables, Reference variables.

(6 Hrs Lecture)

UNIT-II

Operators in C++: Scope resolution operators, Member dereferencing Operators, Memory Management Operators, Manipulators, Type cast operators. Functions: The main () function, Function Prototyping, Call by reference, Return by reference, Inline function, and Function Overloading.

Classes and Objects: Introduction, A C++ Program with Class, Defining member Functions, Nesting of Member functions, Private member functions, Memory Allocation for Objects, Static Data members, Static Member Functions, Arrays within a Class, Arrays of Objects, Objects as Function Arguments, Friend Functions, Returning Objects.

Operator Overloading: Defining Operator Overloading, Overloading Unary Operators, and Overloading Binary Operators, Type Conversions.

(8 Hrs Lecture)

UNIT-III

Pointers: Declaration and initializing, Manipulation of pointers, pointers Expression and Pointer Arithmetic, Pointer with Arrays, Arrays of Pointers, Pointers to objects, this pointers, Arrays of Pointers to Objects.

Constructors and Destructors: Constructors, Parameterized Constructors, Multiple Constructors in a class, Copy constructors, and Destructors.

Inheritance and Polymorphisms: Introduction, Defining Derived Classes, Single inheritance, Multiple inheritance, Hierarchical inheritance, Multilevel inheritance, Hybrid inheritance,

Virtual Base Classes, static and dynamic binding, Constructor in Derived Classes, Pointers to Derived Classes, Virtual Functions, Pure Virtual Functions.

(8 Hrs Lecture)

UNIT-IV

Templates and Exception Handling: Function templates, Function templates with multiple arguments, Class templates, Exceptional Handling (Try, throw and catch), Use of exceptional handling.

I/O Operations and Files: C++ Stream Classes, Unformatted I/O Operations, Formatted I/O operations, Classes for File Streams, Opening and Closing a File: open() and close() functions, Manipulators of File Pointers: seekg(), seekp(), tellg(), tellp() functions, Sequential Input and output Operations: put (), get(), write(), read() functions, Error handling File Operations: eof(), fail(), bad(), good() .

(8 Hrs Lecture)

Suggested Books and References:

1. Robert Lafore, Object Oriented Programming in C++, Fourth Edition, SAMS publications.
2. Herbert Schildt, C++ The Complete Reference, Fourth Edition, Tata McGraw Hill Publication.
3. E. Balagurusamy - Object Oriented Programming with C++ - TMH
4. Deitel and Deitel, C++ How to Program, Third Edition, Pearson Publication.
5. Joyce Farrell, Object-oriented programming using C++, Fourth Edition, Cengage Learning.

Course Learning Outcomes:

1. Able to develop programs with reusability.
2. Develop programs for file handling.
3. Handle exceptions in programming.
4. Develop applications for a range of problems using object-oriented programming techniques.

Syllabus

CCT-52P-ESC-123-C++ Computer Programming Lab

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
II	CCT-52P-ESC-123	C++ Computer Programming Lab			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	ESC	-	02	02	60 Hours Lab	
Prerequisites		XII Standard from the Central Board of Secondary Education or equivalent.				
Objectives of the Course:		1. to know about Object-oriented programming. 2. To Use Abstract Data Types in the programs. 3. Application of non-recursive functions. 4. OOP principles like Encapsulation Inheritance Polymorphism were frequently used.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-52P-ESC-123–C++ Computer Programming Lab	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for the **C++ Computer Programming Lab** should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-52P-ESC-123-C++ Computer Programming Lab

Programming Assignments:

1. Write a C++ program to find the sum of all the natural numbers from 1 to n.
2. Write a C++ program to swap 2 values by writing a function that uses call-by-value and call-by-referencetechniques.
3. Write a C++ program to display the Names, Roll No., and grades of 3 students who have appeared in the examination. Declare the class of name, roll no., and grade. Create an array of class objects. Read and display the contents of the array.
4. Write a C++ program to read the data of N employees and compute the net salary of each employee (HINT: DA=52% of basic and IT=30% of gross salary).
5. Write a C++ to illustrate the concepts of console I/O operations.
6. Write a C++ program to implement the concept of function overloading and operator overloading using the friend function.
7. Write a C++ program to demonstrate the concept of inheritance in C++.
8. Write a C++ program to use the pointer for both base and derived classes and call the member function (Use virtual keyword).
9. Write a C++ program to demonstrate the usage of try, catch and throw to handle the exception.
10. Write a C++ program to create a text file, check file is created or not, if created it will write some text into the file and then read the text from the file.

Suggested Books and References:

1. Data Structures Using C And C++ -Yedidyah Langsam &M.Tenenbaum
2. Object-Oriented Programming In C++ -Nabajyoti Barkakati
3. Object-Oriented Programming In C++ -E Balagurusamy

Course Learning Outcomes:

Upon successful completion of this lab the student will be able to Develop Applications For a range of Using Object-Oriented Programming Techniques.

CCT-52T-MC-102-Environmental Studies

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
II	**CCT-52T-MC-102**	**-Environmental Studies**			5	**00**
Level of Course	**Type of the Course**	**Credit Distribution**			**Course Delivery Method**	
		Theory	**Practical**	**Total**		
Introductory	MC	00	00	00	30 Lectures	
Objectives of the Course:		• To make students aware of the importance of the physical environment and its various components. • To make students realize their role in the protection and maintenance of a healthy environment for sustainable development. • To understand the significance and issues related to natural resources, ecosystems, and biodiversity. • To encourage them to explore ways of managing/ conserving natural resources. • To develop an understanding of causes and sources of environmental pollution and their impact on quality of life. • To educate young minds about environmental movements and laws. • To encourage to adoptionof sustainability as a practice in life, society, and industry.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	**CCT-52T-MC-102**	**1 Hrs-CA** **4 Hrs-EoSE**	**10 Marks-CA** **40 Marks-EoSE**	**4 Marks-CA** **16 Marks-EoSE**

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 9 marks.

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Detailed Syllabus

CCT-52T-MC-102-Environmental Studies

Unit-I

Human and the Environment

Definition, scope and multidisciplinary nature of Environmental Studies. Need for Environmental awareness and environmental education in the present-day context.

Population growth, variation among nations, Population explosion: Family Welfare Programme, Impacts of rising population on human health and environment.

Human Rights, Environmental ethics, World food problems, Role of Information Technology in Environment and human health.

[6 Hours Lecture]

Unit-II

Natural Resources,Management and Sustainability

Classification of resources: renewable and non-renewable resources.

Forest resources: Use and over-exploitation, causes and impacts of deforestation.

Water resources: Use and over-utilization of surface and groundwater, floods, drought, and conflicts over water.

Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, related case studies.

Energy resources: Growing energy need, renewable and non-renewable energy sources, use of alternate energy sources. Related case studies.

Land resources, Land degradation, fertilizer-pesticide problems, water logging, salinity, soil erosion and desertification. changes caused by agriculture and overgrazing, effects of modern agriculture.

Sustainability and resource conservation: Sustainable development, Sustainable Development Goals, Equitable use of resources for sustainable lifestyles, resource conservation, rainwater harvesting, watershed management, wasteland reclamation.

[8 Hours Lecture]

Unit-III

Ecosystem and Biodiversity

Concept, Structure and functions of the ecosystem: Producers, consumers and decomposers, Energy flow in the ecosystem, Food chains, food webs and ecological pyramids.

Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristics- forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services- classification and their significance.

Concept, definition and types of biological diversity (genetic, species and ecosystem diversity). Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic, option values.

Threats to biodiversity, Biodiversity at global, national and local level, Hot-spots of biodiversity. India as a mega-diversity nation, Biogeographical classification of India, Endangered, Threatened and endemic species of India.

Conservation of biodiversity: *In-situ* and *Ex-situ* conservation of biodiversity, Red Data Book

[8 Hours Lecture]

Unit-IV

Environmental Issues

Definition, Causes, effects and control measures of: Air, Water, Soil, Marine, Noise, Thermal, Nuclear. Greenhouse gases and their impacts, Climate change, Global warming, Acid rain, Ozone layer depletion, Nuclear accidents and holocaust.

Solid waste management: Generation and management of urban, industrial, biomedical and e-wastes. Waste Management- Concept of 3R (Reduce, Recycle and Reuse).

Environmental Protection Act, Water (Prevention and Control of Pollution) Act, Air (Prevention and Control of Pollution) Act, Wild life protection Act, Forest Conservation Act, Biological Diversity Act.

Social issues: Resettlement and rehabilitation of people: its problems and concerns. Environmental movements: Chipko, Appiko movement, Silent valley, Big dam movements. Environmental audit and Environmental Impact Assessment.

International agreements: Earth Summits, Convention on Biological Diversity (CBD), Montreal Protocol, Kyoto protocol.

[8 Hours Lecture]

Suggested Books and References:

1. Ahluwalia, V. K. (2016) Environmental Studies: Basic concepts. Energy and Resources Institute
2. Asthana, D. K. (2006). Text Book of Environmental Studies. S. Chand Publishing.
3. Basu, M. and Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
4. Basu, R. N. (Ed.) (2000). Environment. University of Calcutta, Kolkata.
5. Bharucha, E. (2013). Textbook of Environmental Studies for Undergraduate Courses. Universities Press.

6. Fisher, Michael H. (2018). An Environmental History of India- From Earliest Times to the Twenty-First Century, Cambridge University Press.
7. De, A.K. (2006). Environmental Chemistry, 6th Edition, New Age International, New Delhi.
8. Headrick, Daniel R. (2020) Humans versus Nature- A Global Environmental History, Oxford University Press.
9. Jha L. and Shailendra, Environmental Studies, CBH publications, Jaipur
10. Manahan, S.E. (2022). Environmental Chemistry (11th ed.). CRC Press.
11. Rajagopalan, R. (2011). Environmental Studies from Crisis to Cure. Oxford University Press
12. Sharma, P. D. (2005). Ecology and Environment. Rastogi Publications.
13. Singh, J.S., Singh, S.P. and Gupta, S.R. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications

Course Learning Outcomes:

After completion of this course, students will be able to:

- Gain in-depth knowledge of natural processes and resources that sustain life and govern the economy.
- Develop critical thinking to shape strategies (scientific, social, economic, administrative, and legal) for environmental protection, conservation of biodiversity, protection of natural resources and sustainable development.
- Understand and predict the consequences of human actions on the environment and quality of human life.
- Acquisition of values and attitudes towards understanding complex environmental economic-social challenges.
- Actively participate in solving current environmental problems and preventing future ones.

SEMESTER-WISE PAPER TITLES WITH DETAILS

DD0401 – Dual Degree B.Tech.-M.Tech. in Converging Technologies III-Semester							
#	Semester	Type	Title	Credits			
				L	T	P	Total
1.	III	HSMC	CCT-63T- HSMC-201–Industrial Economics	2	0	0	2
2.	III	BSC	CCT-63T-BSC-201–Quantum Physics	2	0	0	2
3.	III	BSC	CCT-63T-BSC-202-Principle and Application of Molecular Spectroscopy	2	0	0	2
4.	III	BSC	CCT-63T-BSC-203-Advanced Mathematics	2	0	0	2
5.	III	BSC	CCT-63T-BSC-204-Development Biology	2	0	0	2
6.	III	PCC	CCT-63P-PCC-201-Solid State Physics	2	0	0	2
7.	III	PCC	CCT-63P-PCC-202-Molecular Biology	2	0	0	2
8.	III	PCC	CCT-63P-PCC-203-Cognitive Psychology	2	0	0	2
9.	III	PCC	CCT-63T-PCC-221-Material Science Lab	0	0	2	2
10.	III	PCC	CCT-63T-ESC-222-Psychology Lab	0	0	2	2
11.	III	ESC	CCT-63T-ESC-201-Programming in Java	2	0	0	2
12.	III	ESC	CCT-63P-ESC-221- Java Programming Lab	0	0	2	2
13.	III	MC	CCT-63F-MC-201-Anandam-II	0	0	0	0
				16	**0**	**6**	**22**

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CCT-63T-HSMC-201-Industrial Economics

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III	**CCT-63T-HSMC-201**	**Industrial Economics**			6	**02**
Level of Course	**Type of the Course**	**Credit Distribution**			**Course Delivery Method**	
		Theory	**Practical**	**Total**		
Intermediate	**HSMC**	**02**	**00**	**02**	30 Lectures	
Objectives of the Course:		To provide the students an insight into the basic concepts & analytical tools of economics related to firm/industry/organization. The course involves the understanding of the markets, industrial environment, policies and problems of industrial growth and development.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	**CCT-63T- HSMC-201– Industrial Economics**	**1 Hrs-CA** **1 Hrs-EoSE**	**10 Marks-CA** **40 Marks-EoSE**	**4 Marks-CA** **16 Marks-EoSE**

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

Unit 1

Introduction to Industrial Economics

- Scope of Industrial Economics
- Basic Concepts: Demand, Supply, Firm, Plant, and Industry
- Market Structures, Pricing under Various Structures, Optimum firm size **(8 Lectures)**

Unit II
Industrial Location and Development

- Industrial Location: Theories and Measures of Industrial Localization
- Industrialization and Development
- Interdependence of Industrial Sectors: Backward and Forward Linkages **(7 Lectures)**

Unit III
Management and Market Dynamics

- Separation of Ownership and Management
- Alternative Models to Profit Maximization: Baumol, Williamson, Marries
- Seller Concentration: Barriers to Entry, Economies of Scale, Mergers **(8 Lectures)**

Unit IV
Industrialization in India

- Industrialization in India and Challenges: Balanced and Unbalanced Regional Development
- Evolution of Industrial Policy
- Pattern of Industrial Growth and changes in Industrial Sector since 1951 **(7 Lectures)**

Suggested Books and References:

1. Industrial Economics, An Introductory Text Book, R.R. Barthwal; New Age International (P) Limited.
2. Economics; Samuelson, Nordhaus; Tata Mc Graw Hill, New Delhi.
3. Industrial Economics, A K Sharma; Anmol Publications.
4. Industrial Economics: Theory and Evidences, D. Hay and D. J. Morris; Oxford University Press, London

Course Learning Outcomes:

1. Students will be able to understand and analyse the core concepts of industrial economics, including market structures, pricing mechanisms, and optimum firm size, and apply them to real-world industry scenarios.
2. It will develop the ability in students to evaluate the theories and factors influencing industrial location, and assess how industrialization contributes to economic development, with a focus on sectoral linkages and regional disparities.
3. Students will be able to critically assess the separation of ownership and management within firms, and evaluate alternative models to profit maximization and their impact on market behaviour and firm strategy.
4. Students will gain a thorough understanding of the challenges and patterns of industrialization in India, analysing the evolution of industrial policy and its impact on regional development and industrial growth since 1951.

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CCT-63T-BSC-201-Quantum Physics

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III	CCT-63T-BSC-201	Quantum Physics			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	BSC	02	-	02	Lectures	
Objectives of the Course:		This course aims to introduce the fundamental principles of quantum mechanics, highlighting its necessity over classical mechanics through key historical experiments. It equips students with essential mathematical tools, including operators, wavefunctions, and Dirac notation, to develop a strong theoretical foundation. The course covers the Schrödinger equation and its applications to basic quantum systems such as potential wells and tunneling. Additionally, it explores the concepts of angular momentum, spin, and their significance in quantum systems.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-63T-BSC-201-Quantum Physics	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-63T-BSC-201 (Quantum Physics)

Unit 1 **[8 Hours]**

Historical Background: Failures of classical mechanics, Planck's Hypothesis, Blackbody Radiation, Photoelectric Effect, Wave-Particle Duality: De Broglie Hypothesis, Compton Scattering, Heisenberg Uncertainty Principle, wave packets

Operators in quantum mechanics: Linear operator, unitary operator, function operator. Adjoint of an operator, self adjointness, eigen values and eigen functions of self adjoint operator. Normalization of eigen functions, Completeness and closure relation.

Unit 2 **[7 Hours]**

Basic postulates of Quantum Mechanics, Wavefunction, Concept of Superposition and Wavefunction Collapse, Observables and Operators, Measurement in Quantum Mechanics, Time Evolution of the System's State, Symmetries and Conservation Laws, Poisson Brackets and Commutators

Unit 3 **[8 Hours]**

Time-dependent and Time-independent Schrödinger Equations, Interpretation of Wavefunctions and Probability Density, Particle in a One-Dimensional Potential Well, Finite Potential Well and Quantum Tunneling, Expectation Values and Ehrenfest's Theorem

Unit 4 **[7 Hours]**

Orbital Angular Momentum operator, Eigenvalues and Eigenfunctions of L^2&L_z , Spin Angular Momentum and Pauli Matrices, Stern-Gerlach Experiment, Quantum Harmonic Oscillator (Qualitative and Energy Levels), Hydrogen Atom and Energy Levels (Qualitative)

Course outcomes:

At the end of the course, students will be able to :

CO1: Explain the fundamental principles of quantum mechanics.

CO2: Apply mathematical tools to solve basic quantum mechanics problems.

CO3: Analyze the behavior of quantum systems using Schrödinger's equation.

CO4: Evaluate quantum mechanical models and their real-world applications.

Suggested reference books:

1. David J. Griffiths – *Introduction to Quantum Mechanics, Pearson Education*
2. J.J. Sakurai & Jim Napolitano – *Modern Quantum Mechanics, Cambridge University Press*
3. R. Shankar – *Principles of Quantum Mechanics, Plenum Press*
4. A. K Ghatak and S Lokanathan, Quantum Mechanics: Theory and application.

Suggested E-resources :

1. MIT OpenCourseware - 8.04 Quantum Physics I (https://ocw.mit.edu/courses/8-04-quantum-physics-i-spring-2016/pages/video-lectures/)

2. NPTEL – Quantum Mechanics I (https://archive.nptel.ac.in/courses/115/101/115101107/)

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CCT-63T-BSC-202 Principles and Applications of Molecular Spectroscopy

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III	CCT-63T-BSC-202	Principles and Applications of Molecular Spectroscopy			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	BSC	02	-	02	Lectures (Thirty)	
Objectives of the Course:		To understand the fundamental principles of molecular spectroscopy, including the interaction of light with matter and the mechanisms of absorption and emission of radiation. To explore vibrational and rotational spectra, their interpretation, and the influence of molecular structure on spectral features, including functional group analysis. To study electronic transitions, Beer-Lambert's law, and the effects of solvents and conjugation on absorption spectra, with practical applications in UV spectroscopy. To gain proficiency in Proton Magnetic Resonance (PMR) spectroscopy, understanding chemical shifts, anisotropic effects, and factors influencing the NMR spectra of various organic compounds.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-63T-BSC-202 -Principles and Applications of Molecular Spectroscopy	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

Principles and Applications of Molecular Spectroscopy

Unit - I

General Principles: Interaction of light with matter, mechanism of absorption & emission of radiation. Vibrational spectra of diatomics. Hook's law, effect of anharmonicity, Morse potential Fundamental vibrations of polyatomic molecules, overtones, hot bonds. Intensity and position of IR bands, fingerprint region. **(7 Lectures)**

Unit - II

Characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds Solvent effect and effect of H-bonding on vibrational frequency.Qualitative treatment of Rotational Raman effect, Effect of nuclear Spin: Raman activity of vibrations, rule of mutual exclusion, vibrational Raman spectra, Stokes and anti-Stokes lines their intensity difference. **(8 Lectures)**

Unit -III

Absorption laws (Beer-Lambert's law), molar absorptivity, Types of electronic transitions, effect of solvent on transitions, effect of conjugation Chromophores and Auxochromes, Bathochromic hypsochromic, hyperchromic and hypochramic shifts UV spectra and application of Woodward Rules for calculation of max for the conjugated enes (alicyclic, homoannular and heteroannular) and enones. **(7 Lectures)**

Unit-IV

Basic principles of Proton Magnetic Resonance shielding and de-shielding of magnetic nuclei Anisotropic Effects in Alkene, alkyne, Cycloaikane, Carbonyl compounds and benzene, Chemical Shift and factors influencing in chemical shift values of various chemically non-equivalent protons and correlation to protons bonded to carbon (aliphatic, olefinic, aldehydic and aromatic). **(8 Lectures)**

Suggested Books and References –

1. C. N. Banwell and E. M. McCash, Fundamentals of Molecular Spectroscopy, 4th edn. Tata McGraw-Hill, New Delhi, 1994.

2. R M Silverstein, GC Basseler& T. C. Morill. Spectroscopic Identification of Organic Compounds, John Wiley (1981)

3. W Kemp Organic Spectroscopy (3rd edn.), McMillan Press Ltd. (1991)

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4. D Williams & 1 Fleming Spectroscopic Methods in Organic Chemistry, McGraw Hill (1909)

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Understand the basic principles of molecular spectroscopy, including the interaction of light with matter and the mechanisms behind absorption and emission of radiation.

2. Analyze vibrational and rotational spectra, including IR and Raman spectroscopy, and interpret the effects of molecular structure on spectral features.

3. Apply Beer-Lambert's law to understand absorption spectra, and interpret the effects of solvent and conjugation on electronic transitions.

4. Use Woodward's rules to predict UV absorption maxima for conjugated systems, and understand the shifts in UV spectra due to chromophores and auxochromes.

5. Develop the ability to interpret Proton Magnetic Resonance (PMR) spectra, including factors influencing chemical shifts and the anisotropic effects in different functional groups.

6. Correlate spectral data with molecular structure, and apply this knowledge in the qualitative and quantitative analysis of organic compounds.

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CCT-63T-BSC-203 Advanced Mathematics

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III	CCT-63T-BSC-203	Advanced Mathematics			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	BSC	02	-	02	Lectures (Thirty)	
Objectives of the Course:		The primary objective of this course is to introduce the real number with algebraic, order, completeness properties, and convergence/ divergence of sequences. The course also offers the solution strategies to differential equations viz. Linear, homogeneous linear, linear equations with constant coefficients and allied types.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-63T-BSC-203-Advanced Mathematics	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.
PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-63T-BSC-203 Advanced Mathematics

Unit - I

Bounded set, Neighbourhood, Limit point, Bolzano-Weierstrass theorem, closed and Open sets. Concept of compactness and connectedness.

(7 Lectures)

Unit - II

Real sequences- Limit and Convergence of a sequence, Monotonic sequences. Cauchy's sequences, Subsequences, Cauchy's general principle of convergence. Continuous functions: Properties of continuous functions on closed intervals.

(8 Lectures)

Unit -III

Exact differential equations and equations which can be made exact. First order but higher degree differential equations solvable for x,y and p. Linear differential equations with constant coefficients, Complementary function and Particular integral.

(7 Lectures)

Unit-IV

Homogeneous linear differential equations, Linear differential equations of second order. Solution by transformation of the equation by changing the dependent variable/the independent variable, Method of variation of parameters, Method of undetermined coefficients.

(8 Lectures)

Suggested Books and References –

1. Royden H, Fitzpatrick PM. Real analysis. China Machine Press; 2010.
2. Rudin W. Principles of mathematical analysis. New York: McGraw-hill; 1964.
3. Bartle RG, Sherbert DR. Introduction to real analysis. New York: Wiley; 2000.

4. Mapa SK. Introduction to Real Analysis. Sarat Book Distributors; 2014.
5. Malik SC, Arora S. Mathematical analysis. New Age International; 1992.
6. Ross SL, Differential Equation-Jhon Wiley & Sons. Inc. New York. 1984.
7. Raisinghania MD, Ordinary and partial differential equations. S. Chand Publishing; 2013.

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Apply Bolzano-Weierstrass and Heine-Borel theorems to real number sets.
2. Test sequence convergence using Cauchy's principle and analyse continuous functions on closed intervals.
3. Solve first-order and higher-degree differential equations and linear differential equations with constant coefficients.
4. Solve second-order linear differential equations using transformation techniques and assess linear independence of solutions.

CCT-63T-BSC-204-Developmental Biology

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III	CCT-63T-BSC-204	Developmental Biology			6	03
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	BSC	02	-	02	Lectures	
Objectives of the Course:		The objectives of this course are to provide a comprehensive understanding of plant and animal developmental biology, emphasizing key processes such as meristem activity, organ formation, and gametogenesis. Students will explore embryogenesis in plants and animals, molecular mechanisms governing development, and genetic regulation of key pathways. The course also covers stem cells, regeneration, and cloning techniques, integrating classical and modern approaches to developmental biology, with a focus on molecular genetics and evolutionary perspectives.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-63T-BSC-204-Developmental Biology	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.
PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-63T-BSC-204-Developmental Biology

UNIT I

Vegetative Phase of Plant Development: Meristems, Shoot, Root apical meristems, Primary, Secondary, Auxiliary, Intercalary, Floral and inflorescence meristems; Leaf development: Arrangement of Leaf primordia and their genetic programming; Root Development: Root tip developmental zones. Root apical meristems and cell differentiation.
Structure of flower and floral characteristics: Floral architecture, types, Floral transition, Development of sepals and petals; Development of male gametophyte: Microsporogenesis, Anther wall. Sporogenous tissue; Development of female gametophyte: Megasporogenesis, Pollination and fertilization, Endosperm.

(8 Hrs)

UNIT II

Embryo development: Embryogenesis in Monocotyledons and Dicotyledons, establishment of the essential features of the mature plants, Axial and radial patterning; Seed-structure and development: Monocot and Dicot seeds and their development. Genetic control of plant development, MADS box and Homeobox genes.

(7 Hrs)

UNIT III

Structure of the gametes: Sperm and Egg; Fertilization: Gamete fusion, Fusion of the gametic material, Rearrangement of the egg cytoplasm and Early development; Cleavage: Definitions, Planes and Patterns, Morulation, Blastulation, Gastrulation; Morphogenic cell movements and significance.

(7 Hrs)

UNIT IV

Limb and organ regeneration; Stem cells: Types and Applications; Animal cloning: Embryonic nuclear transfer techniques, Nuclear transfer technique. Embryonic clone and Teratology; Molecular Biology of Animal Development: Drosophila life-cycle and overall development ; Setting up the body axes; Localization of maternal determinants during oogenesis; Patterning the early embryo. Activation of the pair-rule genes and the

establishment of parasegments, segmentation genes and compartments; Specification of segment identity. (8 Hrs)

Recommended Books

- Plant Physiology – Lincoln Taiz, Eduardo Zeiger. 4th Edition. Sinauer Associates, Inc.
- Developmental Biology – Lewis Wolpert. Oxford University Press.
- Embryology of Angiosperms – S.S. Bhojwani, S.P. Bhatnagar. Vikas Publishing House Pvt Ltd.
- Biochemistry and Molecular Biology of Plants – Bob B. Buchanan, Wilhelm Gruissem, Russell L. Jones. American Society of Plant Biologists (ASPB), Wiley-Blackwell.
- Developmental Biology – Scott F. Gilbert. 8th Edition Sinauer Associates, Inc.

Course Outcome:

- Study plant vegetative development, meristems, leaf and root formation, and floral structure.
- Learn embryo development, seed formation, and genetic control of plant development.
- Understand gamete structure, fertilization, cleavage, and early embryonic development.
- Explore regeneration, stem cells, cloning, and molecular mechanisms of animal development.

CCT-63T-PCC-201-Solid State Physics

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III	CCT-63T-PCC-201	Solid State Physics			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	PCC	02	-	02	Lectures	
Objectives of the Course:		The course aims to provide a comprehensive understanding of the structural, electronic, thermal, magnetic, and dielectric properties of solids. It introduces the fundamental principles of crystal structures, bonding in solids, lattice vibrations, and electron theories. Students will learn the applications of X-ray diffraction and reciprocal lattice in crystal analysis. The course also develops an understanding of band theory, semiconductors, and their electronic properties. It further explores magnetic and dielectric behaviors along with the phenomenon of superconductivity. The objective is to equip students with the conceptual and analytical tools required to study and apply solid-state physics in research and technology.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-63T-PCC-201-Solid State Physics	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.
PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-63T-PCC-201-Solid State Physics

Unit I

Crystal structure: Crystal lattice and translation vectors, unit cell, basis, types of lattices, lattice directions and planes, interplanar spacing, simple crystal structures, close-packed structures, loose-packed structures, ZnS (Zinc Blende) structure, diamond structure, sodium chloride (NaCl) structure, symmetry operations, point groups and space groups.
X-ray diffraction and Reciprocal Lattice: Bragg's law, Laue's equations, Laue method, rotating crystal method, powder method, Reciprocal lattice, reciprocal lattice vectors, reciprocal lattices for simple cubic (sc), body-centered cubic (bcc), and face-centered cubic (fcc) lattices, properties of reciprocal lattices, Bragg's law in reciprocal lattice, Brillouin zones, Brillouin zones of bcc and fcc lattices, atomic scattering factor, geometrical structure factor.
Bonding in Solids: Interatomic forces, types of bonding in solids including ionic, covalent, metallic, Van der Waals, and hydrogen bonding, binding energy in ionic crystals, Madelung constant, range of interatomic forces, binding energy of inert gas crystals.

[8 Hours]

Unit 2

Lattice vibrations: Vibrations of one-dimensional monoatomic lattice, vibrations of one-dimensional diatomic lattice, phonons, momentum of phonons, inelastic scattering of photons by phonons, classical theory of lattice heat capacity, Einstein's theory of lattice heat capacity, Debye model, density of modes, Debye approximation, limitations of the Debye model
Free Electron Theory of Metals: Drude-Lorentz classical theory (free electron gas model), Sommerfeld quantum theory, free electron gas in one-dimensional and three-dimensional boxes, applications of free electron gas model, electronic specific heat.

[7 Hours]

Unit 3

Band theory of solids: Bloch theorem, Kronig-Penney model, energy versus wave-vector relationship, number of wave functions in a band, velocity and effective mass of electron, distinction between metals
Semiconductors: Intrinsic semiconductors, extrinsic semiconductors, donor and acceptor impurities, drift velocity, mobility and conductivity, carrier concentration, Fermi level, law of mass action,

[7 Hours]

Unit 4

Magnetism in solids: Magnetic Terminology, Types of Magnetism, diamagnetism, paramagnetism, ferromagnetism, antiferromagnetism, and ferrimagnetism, Langevin and Weiss theories, exchange interactions, domains and hysteresis

Dielectric properties of solids: polarization, susceptibility, dielectric constant, electronic, ionic and dipolar polarizability, ferroelectricity, piezoelectricity,
Superconductivity: Meissner effect, type I and II superconductors, critical field and temperature, BCS theory, Josephson effect, flux quantization, high-temperature superconductors, and their applications.

[8 Hours]

Course outcomes:

At the end of the course, students will be able to:

i. Understand and explain the fundamental concepts of crystal structures, unit cells, symmetry operations, and types of lattices, including the determination of crystal planes and directions.
ii. Apply the principles of X-ray diffraction and reciprocal lattice theory to analyze crystal structures using methods such as Bragg's law, Laue method, and powder diffraction.
iii. Describe different types of interatomic bonding in solids and evaluate the binding energy of ionic and inert gas crystals using concepts like Madelung constant.
iv. Analyze lattice vibrations in monoatomic and diatomic chains, understand the concept of phonons, and apply models such as Einstein and Debye to explain the heat capacity of solids.
v. Apply classical and quantum free electron models to understand the behavior of electrons in metals and calculate electronic specific heat and related physical quantities.
vi. Explain the origin of energy bands in solids, distinguish between metals, insulators, and semiconductors, and analyze charge carrier dynamics in intrinsic and extrinsic semiconductors.
vii. Understand and differentiate between various magnetic, dielectric, and superconducting properties of solids, and explain the theoretical frameworks such as Langevin, Weiss, and BCS theories with their technological applications.

Suggested reference books:

- **Solid State Physics** by R.K. Puri and V.K. Babbar
- **Introduction to Solid State Physics** by Charles Kittel
- **Solid State Physics** by Neil W. Ashcroft and N. David Mermin
- **Solid State Physics** by S.O. Pillai
- **Solid State Physics: Structure and Properties of Materials** by M.A. Wahab

Suggested E-resources:

- **MIT Open Course Ware – Solid State Chemistry**
  https://ocw.mit.edu/courses/3-091sc-introduction-to-solid-state-chemistry-fall-2010/

- **NPTEL – Solid State Physics**
  https://nptel.ac.in/courses/115/105/115105099/
- **HyperPhysics – Solid State Physics Section**
  http://hyperphysics.phy-astr.gsu.edu/hbase/Solids/solcon.html.
- **Coursera – Solid State Physics Courses**
  https://www.coursera.org

CCT-63T-PCC-202-Molecular Biology

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III	CCT-63T-PCC-202	Molecular Biology			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	PCC	02	-	02	Lectures	
Objectives of the Course:		This course aims to provide a detailed understanding of nucleic acids, their structure, replication, and the mechanisms governing gene expression and regulation. Students will explore DNA replication, transcription, translation, and post-transcriptional modifications in prokaryotes and eukaryotes. The course also covers gene regulation through operon models, epigenetic modifications, and transcriptional control mechanisms. Additionally, techniques such as nucleic acid isolation, electrophoresis, and the impact of inhibitors on DNA and protein synthesis will be discussed.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-63T-PCC-202-Molecular Biology	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

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PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-63T-PCC-202Molecular Biology

Unit – I

Nucleic acids: DNA structure; Chargaff's rule; Types of DNA; Reannealing and hybridization; DNA replication in prokaryotes and eukaryotes: Polymerases, replication origin, initiation, elongation and termination; Synthesis of telomeric DNA; topological properties; linking number, super helicity, mechanism of topoisomerases; Drugs & inhibitors of DNA synthesis;AgaroseGel Electrophoresis.

(7 Hrs)

Unit – II

Transcription: Prokaryotes – polymerase, promoter, initiation elongation and termination; Eukaryotes – promoters, initiation, elongation, termination and post transcriptional modification of mRNA [capping & polyadenylation, Splicing: L & Y splicing (Group I and II introns) hRNA using spliceosome/snurposome; Ribozymes; Inhibitors of transcription.

(7 Hrs)

Unit – III

Types of RNA: Structural Features (mRNA, rRNA, tRNA); Genetic code: Degeneracy of the code, three rules governing the code; Protein synthesis in prokaryotes and eukaryotes: initiation, elongation and termination; Protein synthesis on membrane bound ribosomes: signal hypothesis, post translation modification in ER and Golgi Complex; Inhibitors of protein synthesis.

(8 Hrs)

Unit – IV

Gene Regulation in Prokaryotes: Operon concept, negative & positive Regulation, inducers, co-repressors and catabolite repression; Negative regulation – *Lac* operon; Positive regulation-*Ara*operon; Regulation by attenuation – *trp* operon.

Gene Regulation in Eukaryotes:Conserved Mechanism of Transcriptional regulation from Yeast to Mammals, Gene Silencing by Modification of Histone and DNA

(8 Hrs)

Recommended Book:

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- Molecular Biology of the Gene – James D. Watson, Tania A. Baker, Stephen P. Bell. Pearson Education; Cold Spring Harbor Laboratory Press.
- Genes IX – Benjamin Lewin. Publisher: Jones and Bartlett Publishers, Inc
- Molecular Biology of the Cell – Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. Garland Science; Taylor & Francis Group.
- Molecular Cell Biology – Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Anthony Bretscher, Hidde Ploegh, Angelika Amon, Matthew P. Scott. W. H. Freeman & Company; Macmillan Learning.

Course Outcome:

- Understand DNA structure, replication mechanisms, and electrophoresis techniques.
- Learn transcription processes, RNA modifications, and inhibitors.
- Study RNA types, genetic code, protein synthesis, and post-translational modifications.
- Explore gene regulation in prokaryotes and eukaryotes, including operons and gene silencing.

CCT-63T-PCC-203-Cognitive Psychology

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III	**CCT-63T-PCC-203**	**Cognitive Psychology**			**6**	**02**
Level of Course	**Type of the Course**	**Credit Distribution**			**Course Delivery Method**	
		Theory	**Practical**	**Total**		
Intermediate	**PCC**	**02**	**-**	**02**	Lectures, including diagnostic and formative assessments	
Objectives of the Course:		1. To understand the meaning, goals, history and different methods of Cognitive Psychology. 2. To gain an understanding of the meaning, nature and theories of attention and perception. 3. To learn about the meaning, nature and theories of executive processes and decision making. 4. To comprehend the definition, concepts and theories related to reasoning and problem solving.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	**CCT-63T-PCC-203-Cognitive Psychology**	**1 Hrs-CA** **3 Hrs-EoSE**	**10 Marks-CA** **40 Marks-EoSE**	**4 Marks-CA** **16 Marks-EoSE**

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.
PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-63T-PCC-203-Cognitive Psychology

UNIT-1

Attention: Nature, Information Processing Theories-Early vs. Late Attentional Selection, Spot Light Theory, Feature Integration Theory and Guided Search, Integrated Competition Theory

(07 Lectures)

UNIT-2

Perception: Meaning. Visual Perception-Top down and Bottom-up Processing Models of Visual Recognition: Template-Matching Models, Feature-Matching Models Recognition -by-Components Model. Configural Models, Network Feedback Models Bayesian approach

(07 Lectures)

UNIT-3

Executive Processes and Decision Making: Executive Processes: Definition, Executive Attention, Switching Attention, Inhibition of Response. Sequencing and Monitoring. Decision Making: Nature of Decision, Expected Utility Model, Framing Effects and Prospect Theory. Judgments in Uncertainty. Decision Making and Role of Emotions

(08 Lectures)

UNIT-4

Problem Solving and Reasoning: Nature and Structure of Problem. Problem Space Theory. Strategies and Heuristics. Analogical Reasoning: Sub-processes and Theories Inductive Reasoning: Nature, General and Specific Inductions: Deductive Reasoning: Nature Syllogism-Categorical and Conditional.

(08 Lectures)

Suggested Books and References:

1. Solso, R.L.: MacLin, M.: MacLin. O. (2013) Cognitive Psychology, Delhi Pearson Education.
2. Riegler, B. R. &Riegier G.R. (2022) Cognitive Psychology: Applying the Science of Mind, Pearson Allyn and Bacon
3. Smith. E.F. &Kosslyn, S.M (2011) Cognitive Psychology: Mind and Brain. PHI Learning

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4. Taylor, S. & Workman, L. (2021) Cognitive Psychology: The Basics. Routledge Publications.
5. Sternberg, R. & Sternberg, K. (2023) Cognitive Psychology. Affiliated East West Press

Suggested E-resources:

Online Lecture Notes and Course Materials

Course Learning Outcomes:

By the end of the Course, Students will be able to:

1. Develop an understanding of the epistemology of Cognitive Psychology and analyze its tools and methods.
2. Analyze and understand the concepts and theories of attention and perception and their role in information processing.
3. Apply the principles of executive processes and decision making.
4. Develop an understanding of different concepts and theories related to reasoning and problem solving.

CCT-63P-PCC-221-Materials Science Lab

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III	CCT-63P-PCC-221	Materials Science Lab			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	PCC	-	02	02	Lab experiments	
Objectives of the Course:		The Materials Lab focuses on investigating the fundamental electrical, magnetic, thermal, and structural properties of materials. Students will determine the Curie temperature of ferromagnets, analyze phase transitions, and study hysteresis loops to extract key magnetic parameters. Semiconductor experiments include Hall effect measurements, resistivity studies using the four-probe method, and energy band gap determination. Additionally, students will explore phonon dispersion in lattice chains, dielectric behavior, and photoconductivity. Structural analysis through X-ray diffraction and magnetoresistance studies further enhances material characterization. These experiments provide a comprehensive understanding of solid-state physics principles essential for advanced research and technological applications.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-63P-PCC-221–Materials Science Lab	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for the **Materials Science Lab**should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

Detailed Syllabus

CCT-63P-PCC-221-Materials Science Lab

1. To determine the Curie temperature of a given ferromagnetic material by studying the variation of magnetization with temperature and to understand the phase transition from ferromagnetic to paramagnetic state.
2. To measure the specific heat capacity of a solid material at different temperatures and to analyze the temperature dependence of heat capacity and compare it with theoretical models like Dulong-Petit and Debye theory.
3. To record the hysteresis loop of ferromagnetic metals and determine key magnetic parameters such as coercivity, retentivity, and saturation magnetization and to study energy loss due to hysteresis and its dependence on material properties.
4. To determine the type (n-type or p-type) and carrier concentration of a semiconductor sample using the Hall effect and to measure the Hall voltage and mobility of charge carriers under an applied magnetic field.
5. To study the vibrational modes in a monoatomic and diatomic lattice chain using an electrical analog and to understand concepts like optical and acoustic phonon modes and their role in solid-state physics.
6. To determine the electrical resistivity of a semiconductor material using the four-probe method and to study the temperature dependence of resistivity and understand intrinsic and extrinsic conduction in semiconductors.
7. To determine the energy band gap of a semiconductor material by measuring its electrical conductivity or optical absorption as a function of temperature and to analyze the temperature dependence of the band gap and compare it with theoretical predictions.
8. To analyze the crystal structure of a given material using X-ray diffraction techniques and to determine lattice parameters and identify the crystalline phase of the sample using Bragg's law.
9. To measure the dielectric constant and loss of a given solid material as a function of frequency and to study the polarization mechanisms and dielectric behavior in insulating and semiconducting materials.
10. To study the variation of electrical conductivity of a semiconductor with incident light intensity and to analyze the effect of photon energy on charge carrier generation and recombination processes.
11. To measure the change in electrical resistance of a material under an applied magnetic field and to analyze the dependence of magnetoresistance on carrier mobility and material properties.

Course outcomes:

Upon completing this lab course, students will develop a strong understanding of the fundamental properties of materials, including their thermal, electrical, magnetic, and structural characteristics. They will gain hands-on experience in measuring material

properties using advanced experimental techniques, enhancing their analytical and problem-solving skills. The course will enable students to interpret data, apply theoretical concepts to real-world materials, and develop proficiency in semiconductor and solid-state physics experiments. Additionally, they will learn to work with instrumentation, analyze phase transitions, and characterize materials for technological applications, preparing them for research and industry roles in materials science and engineering.

Suggested reference books:

1. "Experimental Solid-State Physics" – R. J. Singh
2. "Advanced Practical Physics for Students" – B.L. Worsnop & H.T. Flint
3. "Experimental Physics: Principles and Practice for the Laboratory" – Walter F. Smith
4. "Practical Physics" – G.L. Squires
5. "Laboratory Manual in Applied Physics" – H. Singh & P.S. Hemne

Suggested E-resources:

- MIT OpenCourseWare: https://ocw.mit.edu/courses/6-730-physics-for-solid-state-applications-spring-2003/
- NPTEL (IITs online courses): https://nptel.ac.in/courses/115105099

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CCT-63P-PCC-222-Psychology Lab

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III	**CCT-63P-PCC-222**	**Psychology Lab**			**6**	**02**
Level of Course	**Type of the Course**	**Credit Distribution**			**Course Delivery Method**	
		Theory	**Practical**	**Total**		
Intermediate	**PCC**	**-**	**02**	**02**	Practical Exercises based on testing and experimentation including diagnostic and formative assessments	
Objectives of the Course:		1. To understand the different methods of measurement in Psychology. 2. To gain an understanding of the projective techniques. 3. To learn to assess the measurement tools of personality, intelligence and other aspects. 4. To gain knowledge of conducting experiments in psychology.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	**CCT-63P-PCC-222– Psychology Lab**	**1 Hrs-CA 4 Hrs-EoSE**	**10 Marks-CA 40 Marks-EoSE**	**4 Marks-CA 16 Marks-EoSE**

The Practical examination Scheme for the **Psychology Lab**should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-63P-PCC-221-Psychology Lab

1. Measurement of Personality (Questionnaire Method)
2. Measurement of Intelligence (Performance Test)
3. Assessment of Emotions (PANAS)
4. Assessment of Unconscious motives using Projective Techniques (WAT)
5. Measurement of Decision-Making Styles
6. Experiment on Perception (Figure-Ground Reversal)
7. Experiment on Learning (Human Maze)
8. Experiment on Memory (Meaningful and Nonsense syllables)
9. Experiment on Problem-Solving
10. Data collection and analysis using Survey Method

Suggested Books and References:

1. Mohsin, S. M. (2016) Experiments in Psychology, Motilal Banarsidass Publishing House.
2. Cohen, R. J.; Swerdlik, M. E. (2018) Psychological Testing and Assessment. McGraw-Hill Education.

Suggested E-resources:

Online Lecture Notes and Course Materials

Course Learning Outcomes:

By the end of the Course, Students will be able to:

1. Develop an understanding of measurement in Psychology and analyze its tools and methods.
2. Understand the basic concepts related to testing and assessment in psychology.
3. Develop an understanding of experimentation related to different concepts like learning, memory, perception and problem solving.

CCT-63T-ESC-201-Programming in Java

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III	CCT-63T-ESC-201	Programming in Java			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	ESC	02	-	02	Lectures	
Objectives of the Course:		1. To understand the basic concepts and fundamentals of platform independent object oriented language. 2. To demonstrate skills in writing programs using exception handling techniques and multithreading. 3. To understand streams and efficient user interface design techniques.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-63T-ESC-201-Programming in Java	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.
PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus
CCT-63T-ESC-201-Programming in Java

UNIT-I

Java History: Java features, How Java differs from C++, Java Program Structure, Java Tokens, Java virtual machine, Constants, variables and data types, operators & expressions, control structures, arrays, class & object, garbage collection, finalize() method, constructors and its types , methods, static fields and methods, access control, this reference, overloading methods and constructors, recursion, garbage collection, exploring string class. Inheritance, method overriding, Abstract class, Multiple inheritance, Interfaces, extending Interfaces, Accessing Interface variables.

[7 Hours]

UNIT-II

Packages, Exception Handling & Multithreading: API Packages, Creating packages, Accessing a package, Adding a class to a package, use of super and final keywords, Wrapper classes, Exception types, uncaught exceptions, multiple catch clauses, nested try statements, built-in exceptions, creating your own exceptions, Multithreading; Java thread model, thread priorities, threads synchronization, thread suspending, resuming and stopping threads.

[7 Hours]

UNIT-III

Collection Framework in Java – Introduction to java collections, Overview of java collection framework, commonly used collection classes- Array List, Vector, Hash table, Stack, String tokenizer. Files- Streams- Byte streams, Character streams, Text input/output, Binary input/output, random access file operations, File management using File class. Applets.

[8 Hours]

UNIT-IV

GUI Programming with Java- The AWT class hierarchy, Introduction to Swing, Swing Vs AWT, Hierarchy for Swing components, Overview of some Swing components – Jbutton, JLabel, JTextField, JTextArea, Layout management – Layout manager types – border, grid and flow Event Handling- Events, Event sources, Event classes, Event Listeners, Event sources and Listeners, Delegation event model, Examples: Handling a button click, Handling Mouse events, Adapter classes.

[8 Hours]

Course outcomes:

After successful completion of the course, the students are able to

i. Use the syntax and semantics of java programming language and basic concepts of OOP.
ii. Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.
iii. Apply Java Collections, File Handling, and Applets for efficient data management and application development.
iv. Design event driven GUI and web related applications which mimic the real word scenarios.

Suggested Books:

Text Books:

1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.

Reference Books:

1. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI.
2. Introduction to Java programming, By Y.DanielLiang,Pearson Publication.
3. Understanding OOP with Java, updated edition, T. Budd, Pearson Education.

Suggested E-resources :

1. https://onlinecourses.nptel.ac.in/noc25_cs57/course
2. https://docs.oracle.com/javase/tutorial/uiswing/components/index.html
3. https://www.edx.org/learn/java

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CCT-63P-ESC-221 -Programming in Java Lab

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
III	**CCT-63P-ESC**	**Programming in Java Lab**			**6**	**02**
Level of Course	**Type of the Course**	**Credit Distribution**			**Course Delivery Method**	
		Theory	**Practical**	**Total**		
Intermediate	**ESC**	-	**02**	**02**	Lectures	
Objectives of the Course:		1. To implement the basic concepts and fundamentals of platform independent object oriented language. 2. To demonstrate skills in writing programs using exception handling techniques and multithreading. 3. To implement streams and efficient user interface design techniques.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	**CCT-63P-ESC–Programming in Java Lab**	**1 Hrs-CA** **4 Hrs-EoSE**	**10 Marks-CA** **40 Marks-EoSE**	**4 Marks-CA** **16 Marks-EoSE**

The Practical examination Scheme for the **Programming in Java Lab**

should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus
CCT-63P-ESC-221 -Programming in Java Lab

Recommended Lab exercises:

1. Write a Java program that prints "Hello, World!" to the console.
2. Develop a Java program that uses if-else and switch-case constructs to determine the grade of a student based on an input score.
3. Create a class called Student with attributes like name, age, and marks. Write a program to instantiate multiple objects of the class, and implement methods to display the student details and calculate average marks.
4. Write a Java program demonstrating method overloading.
5. Design a class hierarchy with a base class Animal and derived classes such as Dog and Cat. Override a common method (e.g., makeSound()) in the derived classes, and write a program to demonstrate polymorphic behavior.
6. Create an abstract class Shape with an abstract method calculateArea(). Also, define an interface Drawable with a method draw(). Implement concrete classes (e.g., Circle and Rectangle) that extend Shape and implement Drawable.
7. Write a program that demonstrates importing classes from these packages and using their methods.
8. Write a Java program that performs division of two numbers. Implement exception handling using try-catch blocks to gracefully handle cases like division by zero and invalid input.
9. Develop a multithreaded Java program where two threads print numbers concurrently. Use the Thread class or the Runnable interface to create and start the threads.
10. Write a Java program that demonstrates thread synchronization using the synchronized keyword.
11. Implement a program using an ArrayList to store a list of student names. Use an iterator to traverse and display the list
12. Write separate Java programs that demonstrate the basic operations (insertion, deletion, traversal) on a Hashtable, a Vector, and a Stack.
13. Develop a Java program that reads from and writes to a text file.

14. Create a simple Java Swing application that includes a JFrame with several components (buttons, labels, text fields, and text areas).

Course Outcomes: After successful completion of the course, the students are able to implement:

i. The syntax and semantics of java programming language and basic concepts of OOP.
ii. Apply the concepts of Multithreading and Exception handling to develop efficient and error free codes.
iii. Apply Java Collections, File Handling, and Applets for efficient data management and application development.
iv. Implement event driven GUI and web related applications which mimic the real word scenarios.

Suggested Books:

Text Books:

1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
2. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.

Reference Books:

1. Java How to Program, Sixth Edition, H.M.Dietel and P.J.Dietel, Pearson Education/PHI.
2. Introduction to Java programming, By Y.DanielLiang,Pearson Publication.
3. Understanding OOP with Java, updated edition, T. Budd, Pearson Education.

Suggested E-resources:

1. https://onlinecourses.nptel.ac.in/noc25_cs57/course
2. https://docs.oracle.com/javase/tutorial/uiswing/components/index.html
3. https://www.edx.org/learn/java

CCT-63F-MC-201-Anandam-II

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
I	CCT-63F-MC-201	Anandam-II			6	00
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	MC	-	00	00	60 Hours Field Activity	
Objectives of the Course:		Students are expected to engage in – 1. An individual act of goodness, caring, sharing and giving (time and energy) every day 2. Group activity – a project in service of the local community (Group Community Service Project) 3. 3. Apply their knowledge and skills to solve specific community problem 4. Learn to plan, lead and organise community events. 5. Have a sense of belonging to their college campus and community and find something they are interested in doing in their free time. 6. Make new friends, expand social network, and boost social skills and mental health. 7. Be useful to society as it will protect them against stress, frustration and depression				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Practical	CCT-63F-MC-201–Anandam-II	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

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DD0401 – Dual Degree B.Tech.-M.Tech. in Converging Technologies IV-Semester								
#	Semester	Type	Course Code	Title	Credit			
					L	T	P	Total
1.	IV	HSMC	CCT-64T-HSMC-202	Entrepreneurship	2	0	0	**2**
2.	IV	BSC	CCT-64T-BSC-205	Physics of Materials	2	0	0	**2**
3.	IV	BSC	CCT-64T-BSC-206	Quantum Chemistry	2	0	0	**2**
4.	IV	BSC	CCT-64T-BSC-207	Numerical Methods	2	0	0	**2**
5.	IV	BSC	CCT-64T-BSC-208	Bio-Statistics	2	0	0	**2**
6.	IV	PCC	CCT-64T-PCC-204	Microbiology	2	0	0	**2**
7.	IV	PCC	CCT-64T-PCC-205	Database Management System	2	0	0	**2**
8.	IV	PCC	CCT-64T-PCC-206	System Analysis and Design	2	0	0	**2**
9.	IV	PCC	CCT-64P-PCC-223	Microbiology Lab	0	0	2	**2**
10.	IV	ESC	CCT-64P-ESC-222	Tinkering Lab	0	0	2	**2**
11.	IV	ESC	CCT-64P-ESC-223	LAMP Project Lab	0	0	2	**2**
12.	IV	MC	CCT-64F-MC-202	Constitution of India	0	0	0	**0**
					16	**0**	**6**	**22**

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CCT-64T-HSMC-202-Entrepreneurship

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
IV	CCT-64T-HSMC-202	Entrepreneurship			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	HSMC	02	-	02	Lectures (Thirty)	
Objectives of the Course:		1. Introduce fundamental concepts, evolution, types, and mindset of entrepreneurship. 2. Develop skills in business planning, feasibility studies, and legal regulations. 3. Provide insights into market analysis, branding, distribution, and pricing strategies. 4. Familiarize with growth strategies, financial management, and sustainable entrepreneurship.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-64T-HSMC-202-Entrepreneurship	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.
PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-64T-HSMC-202-Entrepreneurship

UNIT-I

Introduction to Entrepreneurship: Entrepreneurship and its Evolution – Definition, Concept, and Importance. Types of Entrepreneurs – Innovators, Imitators, Social Entrepreneurs, Technopreneurs. Entrepreneurial Mindset and Motivation – Characteristics, Risk-taking, Creativity, and Problem-Solving. Entrepreneurial Process – Idea Generation, Opportunity Identification, and Feasibility Study.
(8 Lectures)

UNIT-II

Business Planning and Feasibility Analysis: Business Model and Business Plan – Components and Structure. Market Research and Feasibility Study – Demand Analysis, Competition, and Industry Trends. Legal and Regulatory Aspects – Company Registration, GST, Intellectual Property Rights (IPR), and Taxation.
(7 Lectures)

UNIT-III

Market Dynamics: Market Conditions, Segments, Prediction of Market Changes, Identifying Needs of Customer including Gaps in the Market, Packaging the Product, Market Linkages Branding Issues, Developing Distribution Channels. Pricing/Policies/Competition/Promotion/Advertising/Services Marketing. (8 Lectures)

UNIT-IV

Entrepreneurial Growth and Sustainability: Scaling a Business – Growth Strategies, Expansion, and Diversification. Financial Management for Entrepreneurs – Budgeting, Cash Flow, and Profitability. Corporate Social Responsibility (CSR) and Ethical Entrepreneurship – Social Impact and Sustainable Practices. (7 Lectures)

Suggested Books and References:

- Rao, T. Venkateswara & Pareek, Udai, Developing Entrepreneurship, New Delhi learning system company.
- Bhansali, Entrepreneurship Development, HPB.

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- Sharma, Pradeep, Entrepreneurship and Small Business management, RBSA, Jaipur.
- Desai, Drevasant, Fundamentals of Entrepreneurship and Small business management, Himalya Publishing House Pvt. Ltd.
- Patna, K.K., Fundamentals of Entrepreneurships, Himalya Publishing House Pvt. Ltd.
- Shrivastava, S.B., A Theory Guide to Industrial Entrepreneurship, Sultan Chand & Sons.

Course Learning Outcomes:

On successful completion of this course the students will be able to:

1. Students will be able to demonstrate an understanding of entrepreneurship concepts, types of entrepreneurs, and the entrepreneurial process, including idea generation and feasibility studies.
2. Students will develop the ability to analyze market conditions, create business models, and apply financial and growth strategies for sustainable entrepreneurial ventures.

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CCT-64T-BSC-205-Physics of Materials

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
IV	CCT-64T-BSC-205	Physics of Materials				6	2
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Intermediate	BSC	2	-	2	No	Lectures	
Objectives of the Course:		This course aims to provide a comprehensive understanding of the structural and material properties of solids, including crystalline and non-crystalline states, metals, alloys, ceramics, polymers, and composites. It explores phase diagrams, diffusion mechanisms, and their applications in material processing. The study of ceramics and polymers covers their structures, properties, and industrial applications, while composite materials are analyzed for their mechanical advantages. Additionally, the course delves into corrosion and material degradation, emphasizing prevention techniques. By integrating theoretical concepts with practical applications, students will develop a strong foundation in materials science, enabling them to analyze and select materials for engineering and research purposes.					

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-64T-BSC-205-Physics of Materials	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.
PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

Detailed Syllabus

CCT-64T-BSC-205-Physics of Materials

Unit I

Structure of Solids: The Crystalline and the Noncrystalline States, Covalent Solids, Metals and Alloys, Ionic Solids, The Structure of Silica and the Silicates, Classification of Polymers, Structure of Long Chain Polymers, Crystallinity of Long Chain Polymers.

Phase Diagrams: The Phase Rule, Single-component Systems, Binary Phase Diagrams, Microstructural Changes during Cooling, The Lever Rule, Summary of Phase Diagram Rules, Some Typical Phase Diagrams, Other Applications of Phase Diagrams.

[8 Hours]

Unit 2

Diffusion in Solids: Fick's Laws of Diffusion, Solution to Fick's Second Law, Applications Based on the Second Law Solution, The Kirkendall Effect, The Atomic Model of Diffusion, Other Diffusion Processes.

Structures and Properties of Ceramics - Ceramic Structures, Silicate Ceramics, Imperfections in Ceramics, Mechanical Properties, Thermal Properties, Processing and Applications of Ceramics.

[7 Hours]

Unit 3

Polymer Structures - Hydrocarbon Molecules, Polymer Molecules, Molecular Weight, Molecular Structures, Crystallinity in Polymers, Copolymers.

Characteristics, Applications, and Processing of Polymers - Mechanical Behavior of Polymers, Mechanisms of Deformation, Polymer Types and Applications, Polymer Synthesis, Fabrication of Polymers.

[8 Hours]

Unit 4

Composites - Particle-Reinforced Composites, Fiber-Reinforced Composites, Structural Composites, Properties of Composite Materials, Applications of Composites.

Corrosion and Degradation of Materials - Electrochemical Considerations, Forms of Corrosion, Corrosion Prevention, Environmental Degradation of Polymers.

[7 Hours]

Suggested reference books:

- **Materials Science and Engineering-A first Course by V. Raghavan**
- **Materials Science and Engineering: An Introduction** by William D. Callister & David G. Rethwisch
- **Introduction to Materials Science for Engineers** by James F. Shackelford
- **Physical Metallurgy Principles** by Robert E. Reed-Hill & Reza Abbaschian
- **The Science and Engineering of Materials** by Donald R. Askeland & Wendelin J. Wright
- **Mechanical Behavior of Materials** by Norman E. Dowling
- **Phase Transformations in Metals and Alloys** by David A. Porter, Kenneth E. Easterling & Mohamed Y. Sherif

Suggested E-resources:

- MIT OpenCourseWare: https://ocw.mit.edu/courses/3-012-fundamentals-of-materials-science-fall-2005/
- MIT OpenCourseWare: https://ocw.mit.edu/courses/res-3-004-visualizing-materials-science-fall-2017/
- NPTEL (IITs online courses): https://nptel.ac.in/courses/112108150

Course outcomes:

At the end of the course, students will be able to:

- Understand the structural characteristics of solids, including metals, alloys, ceramics, and polymers.
- Interpret phase diagrams and apply them to predict material behavior during phase transitions.
- Apply diffusion principles in solid-state materials and understand their role in material processing.
- Analyze the structural and mechanical properties of ceramics and polymers for industrial applications.
- Evaluate the properties and applications of composite materials for advanced engineering solutions.
- Identify different forms of corrosion and environmental degradation and propose suitable prevention methods.
- Develop problem-solving skills for selecting and designing materials based on their physical and chemical properties.

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CCT-64T-BSC-206-Quantum Chemistry

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
IV	CCT-64T-BSC-206	Quantum Chemistry			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	BSC	02	-	02	Lectures (Thirty)	
Objectives of the Course:		Provide a comprehensive understanding of quantum mechanics through the Schrödinger equation for various systems, such as a particle in a box and the hydrogen atom. Develop the ability to apply molecular orbital theory and the LCAO approximation to explain chemical bonding and molecular structure. Explore concepts like hybridization, the variation principle, and the Huckel approximation to analyze molecular geometry and conjugated systems. Compare Valence Bond and Molecular Orbital theories to explain molecular properties and bonding in simple molecules.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-64T-BSC-206-Quantum Chemistry	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.
PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-64T-BSC-206-Quantum Chemistry

Unit - I

Schrödinger equation for particle is a box in three dimension (boundary condition, allowed energies and wave function etc), quantum simple harmonic oscillator, energy eigenvalues and eigenstates zero-point energy.

(7 Lectures)

Unit - II

Schrodinger equation for hydrogen atom in terms of polar coordinates, quantum numbers.Born Oppenheimer approximation, molecular orbital, LCAO approximation, expression for bonding and antibonding orbitals.

(7 Lectures)

Unit -III

Molecular potential energy curve structure of simple diatomic molecules overlap integral, importance of electron pair in chemical bonding, molecular orbital energy diagram, classification of molecular orbital and term symbol for diatomic molecules, variation principle (application in helium atom) hybridization as useful concept

(8 Lectures)

Unit-IV

Huckel approximation for conjugated double band (C2H4, allyl system butadiene cyclopropenyl.) calculation of bond order, charge density etc, aromatic stability (benzene) delocalization of energy, valence bond theory of molecular structure of simple molecules, difference between V.B. and M.O. theories

(8 Lectures)

Suggested Books and References –

1. Quantum Chemistry. R.K. Prasad, New age international Pvt. Ltd.
2. 2. Introductory Quantum Chemistry, A.K. Chandra, Tata McGraw-Hill publishing Company Limited.

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Solve the Schrödinger Equation: Derive and solve the Schrödinger equation for a particle in a 3D box and a quantum simple harmonic oscillator, determining energy eigenvalues, eigenstates, and zero-point energy.

2. Analyze Quantum Systems with Polar Coordinates: Solve the Schrödinger equation for the hydrogen atom using polar coordinates, and apply quantum numbers to describe energy levels and orbitals.

3. Apply Molecular Orbital Theory: Understand the Born-Oppenheimer approximation and apply the Linear Combination of Atomic Orbitals (LCAO) method to determine bonding and antibonding orbitals.

4. Understand Hybridization and Molecular Geometry: Explain the concept of hybridization in molecular bonding and use it to predict molecular geometry and bonding in simple molecules.

5. Use Huckel Approximation for Conjugated Systems: Apply the Huckel approximation to study conjugated systems (e.g., C_2H_4, allyl system, butadiene) and calculate bond order, charge density, and aromatic stability, including the delocalization of energy in benzene.

CCT-64T-BSC-207 -Numerical Methods

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
IV	CCT-64T-BSC-207	Numerical Methods			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	BSC	02	-	02	Lectures (Thirty)	
Objectives of the Course:		The primary objective of this course is to enable students to understand fundamental concepts of numericaltechniques viz interpolation, Numerical integration, roots of equation, solution of initial value problem.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-64T-BSC-207-Numerical Methods	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.
PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-64T-BSC-207 -Numerical Methods

Unit - I

Roots of algebraic and transcendental equations: Bisection Method, Regula-Falsi Method, Newton-Raphson Method

(7 Lectures)

Unit - II

Interpolation and Numerical Differentiation: Newton's Forward Difference Interpolation. Newton's Backward Difference Interpolation. Formulae, Numerical differentiation, Newton's divided difference interpolation formulae for unequal interval.

(8 Lectures)

Unit - III

Ordinary Differential Equations: Taylor Series methods, Euler's method, Modified Euler's method, Runge-Kutta Fourth order method

(8 Lectures)

Unit – IV

Numerical Integration: Gaussian quadrature formula, Trapezoidal, Simpson's one-third, Simpson's three-eighth quadrature formula, Weddle's rule.

(7 Lectures)

Suggested Books and References –

1. Wand Chenes and David Kincaid, Numerical Methods and Computing, BrouksLolc 2004
2 Rajaraman V. Computer Oriented Numerical Methods, PHI 1995,
3 K sankara Rao. Numerical Methods for Scientists and Engineers, Prentice Hall ludia
4 Burden RL, Faires JD. Numerical analysis, brooks;1997.
5 Iyengar SR, Jain RK. Numerical Methods. New Age International; 2009.
6 Sastry SS. Introductory methods of numerical analysis. PHI Learning Pvt. Ltd.; 2012.

Course Learning Outcomes:

By the end of the course, students should be able to:

1. Use interpolation formulas for data approximation and numerical differentiation.
2. Use numerical methods to find roots of the equations.

3. Apply numerical methods to solve differential equations.
4. Apply method of least square.

CCT-64T-BSC-208-Bio-Statistics

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
IV	CCT-64T-BSC-208	Bio-Statistic			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	BSC	02	-	02	Lectures	
Objectives of the Course:		This course will introduce students to the fundamental concepts of biostatistics, emphasizing its scope and applications. It will cover data collection, organization, and representation, along with measures of central tendency and dispersion. Students will learn probability theory, random variables, and probability distributions, including binomial, Poisson, and normal distributions. The course will also explore hypothesis testing, sampling distributions, ANOVA, and statistical tests such as F, T, and Chi-square. Additionally, students will study correlation, regression analysis, and computational statistics using MS Excel.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-64T-BSC-208-Bio-Statistics	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.
PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-64T-BSC-208-Bio-Statistics

UNIT I

Introduction to Biostatistics**,** Scope and applications of biostatistics**;** Collection, organization and representation of data (graphical & diagrammatic)**;** Measures of Central tendency & Dispersion (Direct, Short cut and Step deviation methods where ever applicable); Mean, median & mode**;** Mean deviation, Standard deviation & standard error; Variance & coefficient of variation, Confidence interval and level of confidence.

(7Hrs)

UNIT II

Random Variable, discrete and continuous Random variables, Distribution function, Basic concepts related to probability theory, Probability mass function, Probability density function, and probability distribution functions of Random variables. Binomial, Poisson and Normal Distributions & their application in biology; Bayes theorem Normal Probability curve.

(8Hrs)

UNIT III

Sampling distributions - F and Z Distribution; Hypothesis testing, statistical hypothesis (simple and Composites), null hypothesis Alternative hypothesis; Two types of errors, level of significances; Two tailed and one tailed tests, large sample tests; Analysis of variance one way and two-way analysis, ANOVA-table. F & T test, Chi square test (Good fit, distribution & characteristics, application & Yate's correction)

(8Hrs)

UNIT IV

Correlation, Kari Pearson coefficient of correlation, Rank correlation coefficient, Methods of studying correlation; Skewness & measures of skewness; Regression analysis, Regression coefficients, Properties of Regression Coefficients; Computational statistics using MS Excel.

(7Hrs)

Recommended Books:

- Bailey N.T.J., 2000, Statistical Methods in Biology, English Univ Press.
- Bansi L., 1968, Mathematics of Probability of Statistics, S.Chand& Co., Delhi.
- Baxevanis A.D. and Ouellette, 2005, Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd Edition, John Wiley and Son Inc.
- Campbell R.C., 1974, Statistics for Biologist, Cambridge University Press.
- Gralla P., 2000, How the Internet Work, Tech Media.

Course outcomes:

- Gain knowledge of biostatistical concepts and data representation.
- Apply probability theory and statistical distributions in biology.
- Conduct hypothesis testing using various statistical methods.
- Analyze data relationships using correlation, regression, and Excel tools.

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Detailed Syllabus

CCT-64T-PCC-204-Microbiology

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
IV	CCT-64T-PCC-204	Microbiology			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	PCC	02	-	02	Lectures	
Objectives of the Course:		This course provides a comprehensive understanding of microbiology, covering its history, key contributors, and fundamental principles, including spontaneous generation and germ theory. Students will learn microscopy techniques, bacterial morphology, ultrastructure, and cultivation methods. The course explores acellular and cellular microorganisms, their classification, and economic significance. It also examines microbial nutrition, growth, reproduction, and environmental influences. Additionally, principles of sterilization, disinfection, and antimicrobial control methods, including physical and chemical techniques, are discussed.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-64T-PCC-204-Microbiology	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.
PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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CCT-64T-PCC-204-Microbiology

UNIT-I

Introduction to microbiology, History of microbiology and contributions of Anton von Leeuwenhoek, Joseph Lister, Paul Ehrlich, Edward Jenner, Louis Pasteur, Robert Koch, Alexander Fleming,; theory of spontaneous generation, Germ theory of disease and Koch postulates; Scope and relevance of microbiology**.** Difference between prokaryotic and eukaryotic microorganisms.

Principles and application of light microscopy, properties of bright field, dark field, phase contrast and fluorescent microscopy; Principles and application of electron microscopy-transmission and scanning electron microscopy.

(8 Hrs)

UNIT-II

Morphology and ultrastructure of bacteria: Size, shape and arrangement of bacteria, structure and chemical composition of cell wall of Gram -positive and Gram-negative bacteria; Structure, composition and function of cell membrane, capsule, flagella, pili, gas vesicles, cytoplasmic matrix reserve food materials, nucleoid, plasmids. Endospore: structure and formation.

Culture characteristics: Type of culture media, preparation of medium, Minimal requirements; Methods of isolation and maintenance of pure cultures (Pour plate method, streak plate method & spread plate method); Cultivation of bacteria: aerobic &anaerobic; Preservation of culture: Short term & long term

(8 Hrs)

UNIT-III

General characteristics: Acellular microorganisms (Viruses, viroids& Prions), Nomenclature and classification of viruses. Cellular microorganisms with emphasis on distribution, occurrence, morphology, mode of reproduction and economic importance.
Bacteria: *Rhizobium, Clostridium, Lactobacillus &Staphyococcus.*
Fungi: *Sacchromycescerevisae, Penicillum,*
Algae: *Diatoms & Dinoflagellates.*

(7 Hrs)

UNIT-IV

Nutritional categories of microorganisms; Nutritional requirements; Bacterial reproduction; Measurement of microbial growth, direct & indirect measurement of microbial growth; Influence of environmental factors on microbial growth.

Basic principles and methods of sterilization & disinfection: Control of microorganisms by physical methods: heat, filtration and radiation; Chemical methods: Phenolics, alcohols, halogens, heavy metals, quaternary ammonium compounds, aldehydes and sterilizing gases; evaluation of antimicrobial agent effectiveness; Principle and function of Laminar air flow hood (LAF).

(7 Hrs)

Recommended Books:

1. Brook Biology of Microorganisms, by Michael T. Madigan, John M. Martinko, Paul V. Dunlap. Ed. Pearson Publishers, New York
2. Microbiology byLansing M. Prescott, John P. Harley, Donald A. Klein, McGraw-Hill Education, New York, USA.

Course Outcomes:

i. Understand microbiology history, key contributions, and microscopy techniques.
ii. Learn bacterial morphology, structure, and culture methods.
iii. Study classification and significance of bacteria, fungi, algae, and viruses.
iv. Explore microbial growth, nutrition, sterilization, and disinfection methods.

CCT-64T-PCC-205-Database Management System

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
IV	CCT-64T-PCC-205	Database Management System			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	PCC	02	-	02	Lectures	
Objectives of the Course:		Objectives: • To understand the basic concepts and the applications of database systems. • To master the basics of SQL and construct queries using SQL. • To understand the relational database design principles. • To become familiar with the basic issues of transaction processing and concurrency control. • To become familiar with database storage structures and access techniques.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-64T-PCC-205-Database Management System	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.
PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

Detailed Syllabus

CCT-64T-PCC-205- Database Management System

UNIT – I

INTRODUCTION: Introduction and applications of DBMS, Purpose of data base, Data, Independence, Database System architecture. DATABASE DESIGN: Database Design Process, ER Diagrams - Entities, Attributes, Relationships, Constraints, keys, extended ER features, Generalization, Specialization, Aggregation, Conceptual design with the E-R model. SCHEMA REFINEMENT AND NORMAL FORMS: Introduction to schema refinement, functional dependencies, reasoning about FDs. Normal forms: 1NF, 2NF, 3NF, BCNF, properties of decompositions, normalization

UNIT – II

THE RELATIONAL MODEL: Introduction to the relational model, Integrity constraints over relations, Querying relational data, Logical database design: E-R to relational, Introduction to views, Destroying/altering tables and views. RELATIONAL ALGEBRA AND CALCULUS: Preliminaries, relational algebra operators, relational calculus - Tuple and domain relational calculus, expressive power of algebra and calculus.

UNIT – III

TRANSACTION MANAGEMENT AND CONCURRENCY CONTROL: ACID properties, serializability and concurrency control, Lock based concurrency control (2PL, Deadlocks), Time stamping methods, optimistic methods, database recovery management. Recovery system - failure classification, storage structure, recovery and atomicity, log- based recovery, shadow paging, buffer management and failure with loss of non-volatile storage, -Advance Recovery systems- Remote Backup systems.

UNIT – IV

SQL: Basics of SQL, DDL, DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions – numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All ,

view and its types. Transaction control commands – Commit, Rollback, Save point, cursors, stored procedures, Triggers.

Text books:

- Raghu Ramakrishnan & Johannes Gehrke, Database Management Systems, 4th edition, published in 2015 Tata McGraw Hill, New Delhi,India.
- 2Ramez Elmasri & Shamkant Navathe**,** , Fundamentals of Database Systems, 7th Edition, published in June 2015 by Pearson Education,India.

Reference Books:

- Abraham Silberschatz, Henry F. Korth, S. Sudarshan , Database System Concepts, 7th edition released in March 2019, McGraw-Hill, New Delhi,India.
- Peter Rob, Carlos Coronel (2009), Database Systems Design, Implementation and Management, 8th Edition, released in2007**.**

Course Outcomes:

After successful completion of the course, the students are able to

- Demonstrate the basic elements of a relational database management system.
- Ability to identify the data models for relevant problems.
- Ability to design entity relationship and convert entity relationship diagrams into RDBMS and formulate SQL queries on the respect data.
- Apply normalization for the development of application softwares.

CCT-64T-PCC-206-System Analysisand Design

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
IV	CCT-64T-PCC-206	System Analysis and Design			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	PCC	02	-	02	Lectures	
Objectives of the Course:		1. To understand the basic concepts and fundamentals of platform platform-independentobject oriented language. 2. To demonstrate skills in writing programs using exception handling techniques and multithreading. 3. To understand streams and efficient user interface design techniques.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-64T-PCC-206-System Analysis and Design	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.
PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-64T-PCC-206-System Analysisand Design

UNIT I

Basics: System concepts, types of system, elements of system, different approaches to system development; function oriented, object oriented, data oriented, process oriented, DLC, Modelling Methods process Models waterfall, spiral. Prototyping, organizational chart Methodologies and tools of SAD. Different people involve at in System Analysis and Design.
System Development Life Cycle Recognition of need, Implies for system change, feasibility study. Analysis, Design. Implements past for Implementation and Maintenance.

[8 Hours]

UNIT II

Analysis System planning & initial investigator, strategies for determining information requirement, problem definition & project initiation, background analysis, service analysis, efficiency Fact gathering, Fact Analysis and Feasibility study- Economic. Technical, Behavioural feasibility, steps in feasibility study.
Information gathering Need for information gathering, Information gathering tools Onsite observation interviews and questionnaires. Review of Written documents. Types of Interview and Questionnaire, instructed, structured alternation.

[8 Hours]

UNIT III

Tools of Structured Analysis What is structured analysis, various involved (Procedure, pros and cons of each tools) Data Dictionary Decision tree, structured English Data flow diagram DFD notation, content, diagram selves in DFD. Entity Relationship Diagram/ Entities, Attributes, Relationship.

[8 Hours]

UNIT IV

Design-Input/output and forms design - Input design CRT screen design. Output design and Requirement of Form design file organization and database design.
System implementation H/W selection, S/W selection, Make v/s Buy Decision Documentation, Project Scheduling, System Maintenance Security and disaster planning and management's Modern approach to SCLC.

[8 Hours]

Suggested Books:

1. System Analysis and Design, Elias M. Awad. Software Engineering
2. Panka Jalote, Software Engineering pressman.

Suggested E-resources:

1. https://archive.nptel.ac.in/courses/106/108/106108103/#
2. https://archive.nptel.ac.in/courses/106/108/106108103/#

Course outcomes:

After successful completion of the course, the students are able to

1) Understand concepts relating to different types of information systems
2) Explain the purpose and activities of the systems development life cycle phases
3) Understand project management techniques
4) Identify and understand system inputs and outputs
5) Understand and model system entities and data stores
6) Understand and model system processes, events, and data flows within a system
7) Understand and model classes of data within a system
8) Understand concepts relating to various models, tools, and techniques used in system analysis and design.

CCT-64P-PCC-223-Microbiology Lab

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
IV	CCT-64P-PCC-223	Microbiology Lab			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	PCC	-	02	02	Lectures	
Objectives of the Course:		The objectives include understanding laboratory rules, media preparation, and sterilization techniques. Students will perform bacterial isolation using streak, pour, and spread plate methods, identify bacteria through simple and Gram staining, and study fungi and algae using permanent slides. They will also examine plant, animal, and human viruses and quantify viable bacterial cells in culture.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-64P-PCC-223– Microbiology Lab	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for the **Microbiology Lab**should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-64P-PCC-223-Microbiology Lab

Practical:

1. Laboratory rules and requirements, principles and working of basic instruments and equipment
2. Media: (a) Liquid & solid media preparation.
   (b) Sterilization of glass wares and media.
3. Streak plate technique.
4. Pour plate technique and Spread plate technique.
5. Isolation and enumeration of bacteria and fungi from soil samples
6. Identification of various bacteria: Simple staining.
7. Identification of various bacteria: Gram staining.
8. Identification of various fungi and algae (Permanent slides)
9. Study of any one plant, animal and human virus.
10. Quantitation of viable cells in bacterial culture.

Course Outcomes:

- Understand laboratory rules, basic instruments, and equipment.
- Learn media preparation, sterilization, and bacterial isolation techniques.
- Perform staining methods for bacterial and fungal identification.
- Study viruses and quantify viable bacterial cells in culture.

CCT-64P-ESC-222-Tinkering Lab

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
IV	CCT-64P-ESC-222	Tinkering Lab			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	ESC	-	02	02	Practicals	
Objectives of the Course:		By the end of this course, students will be able to: 1. Understand the fundamentals of electronics, microcontrollers, and single-board computers for prototyping. 2. Develop skills in interfacing various sensors, actuators, and communication modules. 3. Apply programming knowledge in Arduino IDE and Python to control hardware devices. 4. Integrate hardware and software components to design and prototype basic robotic and IoT-based applications.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-64P-ESC-222–Tinkering Lab	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for the **Tinkering Lab**should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

Detailed Syllabus

CCT-64P-ESC-222-Tinkering Lab

Practical:

1. Basic Electronics & Circuits
2. Introduction to Arduino and IDE
3. LED Blink
4. PIR Sensor Interfacing
5. Bluetooth Module interfacing
6. Motor Shield interfacing
7. Line follower Robot
8. Bluetooth Controlled Robot
9. LCD Shield interfacing
10. Familiarize with Raspberry Pi and compatibles
11. Install a suitable Raspberry Pi operating system (Raspberry Pi OS)
12. LED Blink using Raspberry Pi (Python coding)

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Demonstrate basic circuit building and electronic component handling.
2. Write and execute Arduino and Python programs for controlling sensors, actuators, and displays.
3. Design and implement small-scale robotic systems such as line follower and Bluetooth-controlled robots.
4. Deploy working prototypes using Arduino and Raspberry Pi for real-world problem-solving.

CCT-64P-ESC-223-LAMP Project Lab

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
IV	CCT-64P-ESC-223	LAMP Project Lab			6	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Intermediate	ESC	-	02	02		
Objectives of the Course:		By the end of this course, students will be able to: 1. Understand the architecture, components, and setup of the LAMP stack for web application development. 2. Develop dynamic and database-driven web applications using PHP and MySQL. 3. Implement essential web functionalities including authentication, file handling, AJAX interactions, and API integration. 4. Apply security practices and deployment strategies for delivering production-ready web applications.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-64P-ESC-223–LAMP Project Lab	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for the **LAMP Project Lab**should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-64P-ESC-223-LAMP Project Lab

1. LAMP Environment Setup & Configuration
2. PHP Fundamentals
3. Working with Forms
4. MySQL Database Basics
5. PHP–MySQL Integration
6. Login & Registration System
7. File Upload & Management
8. CRUD Application
9. AJAX Integration
10. Sending Emails with PHP
11. REST API Development
12. Security in LAMP Applications
13. Using PHP Sessions & Cookies
14. Deployment & Hosting

Course Outcomes:

Upon successful completion of the course, students will be able to:

1. Install, configure, and troubleshoot the LAMP environment on a Linux-based system.
2. Design and develop interactive web applications integrating front-end forms with back-end PHP–MySQL processing.
3. Implement authentication systems, file upload modules, CRUD operations, AJAX-based data handling, and REST APIs.
4. Apply security measures, manage sessions and cookies, and deploy complete LAMP applications to live hosting environments.

CCT-64F-MC-202 Constitution of India

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
IV	CCT-64F-MC-202	Constitution Of India			6	0
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	MC	-	-	-	Lectures	
Objectives of the Course:		1. To familiarize students with the key concepts, principles, and features of the Indian Constitution. 2. To analyse the structure of the Indian government and its organs (Legislature, Executive, and Judiciary). 3. To educate students on the fundamental rights, duties, and directive principles enshrined in the Constitution. 4. To discuss the current relevance of the Constitution in contemporary India, including debates on secularism, federalism, and democracy.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-64F-MC-202-ConstitutionOf India	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-64F-MC-202 Constitution of India

Unit 1: Introduction and Basic Features

- Historical Background: Understanding the context of British rule, nationalist movements, and the formation of the Constituent Assembly.
- Philosophical Foundations: Analysing the values enshrined in the Preamble—Justice, Liberty, Equality, and Fraternity.
- Salient Features: Overview of key characteristics such as the lengthiest written constitution, federal structure, and the parliamentary system.

Unit 2: Fundamental Rights and Duties

- Fundamental Rights:
  - The nature, scope, and significance of Fundamental Rights.
  - Right to Equality (Articles 14–18) and Right to Freedom (Articles 19–22).
  - Other rights including the Right against Exploitation (Articles 23–24), Right to Freedom of Religion (Articles 25–28), Cultural and Educational Rights (Articles 29–30), and Right to Constitutional Remedies (Article 32).
- Fundamental Duties: Understanding the origin, significance, and role of Fundamental Duties in promoting civic responsibility.

Unit 3: Structure of Government

- Union Executive:
  - Role and powers of the President, Vice-President, and the Council of Ministers.
  - The Prime Minister: Functions and significance in the Indian political system.
- Union Legislature:
  - Composition, powers, and functions of the Parliament.
  - Overview of State Executive and Legislature.

Unit-IV

Judiciary and Constitutional Amendments

- Judiciary:
  - Structure and role of the Supreme Court and High Courts.
  - Judicial Review and Activism: Key concepts and landmark judgments.
- Constitutional Amendments:
  - Amendment procedures.
  - Important Amendments: 42nd, 44th, 73rd, and 74th Amendments.
- Current debates and challenges: Secularism, Federalism, and emerging issues like the Right to Privacy and Uniform Civil Code.

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Suggested Books and References:

1. D. D. Basu, Introduction to the Constitution of India, Lexis Nexis, 27th Edition, 2024
2. D. D. Basu, Workbook on Constitution of India, Lexis Nexis, 1st Edition, 2015
3. M. P. Jain, Indian Constitutional Law, Lexis Nexis, 8th Edition, 2018
4. Granville Austin, The Indian Constitution: Cornerstone of a Nation, Lexis Nexis, 1st Edition, 1999

Course Learning Outcomes: The course will enable the students to:

1. Identify and explain the key features, including the Preamble, Fundamental Rights, Directive Principles, and the structure of government.
2. Analyse important provisions and how they apply to the functioning of the Indian state.
3. Understand the significance of major constitutional amendments and landmark Supreme Court rulings.
4. Apply constitutional principles to contemporary legal, social, and political issues in India.

SEMESTER-WISE PAPER TITLES WITH DETAILS

DD0401 – Dual Degree B.Tech.-M.Tech. in Converging Technologies V-Semester							
#	Semester	Type	Title	Credits			
				L	T	P	Total
1.	V	HSMC	HSMC Elective 1	2	0	0	**2**
2.	V	PCC	CCT-75T-PCC-301-Introduction to Nanotechnology	2	0	0	**2**
3.	V	PCC	CCT-75T-PCC-302-Introduction to Nano-Electronics	2	0	0	**2**
4.	V	PCC	CCT-75T-PCC-303-Recombinant DNA Technology	2	0	0	**2**
5.	V	PCC	CCT-75T-PCC-304-Introduction to Bioinformatics	2	0	0	**2**
6.	V	PCC	CCT-75T-PCC-305-Artificial Intelligence	2	0	0	**2**
7.	V	PCC	CCT-75T-PCC-306-Functional Programming Language	2	0	0	**2**
8.	V	PCC	CCT-75T-PCC-307-Introduction to Cognitive Science	2	0	0	**2**
9.	V	PCC	CCT-75T-PCC-308-Introduction to Neuroscience	2	0	0	**2**
10.	V	PCC	CCT-75P-PCC-321-Nano Synthesis Laboratory	0	0	2	**2**
11.	V	PCC	CCT-75P-PCC-322-Recombinant DNA Lab	0	0	2	**2**
12.	V	PCC	CCT-75P-PCC-323-Functional Programming Language Lab	0	0	2	**2**
13.	V	MC	CCT-75F-MC-301-Anandam-III	0	0	0	**0**
				18	**0**	**06**	**24**

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CCT-75T-PCC-301-Introduction to Nanotechnology

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V	CCT-75T-PCC-301	Introduction to Nanotechnology			7	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Advanced	PCC	02	-	02	Lectures	
Objectives of the Course:		This course aims to introduce students to the fundamentals of nanotechnology. It covers the principles behind the behavior of materials at the nanoscale, methods for synthesizing and characterizing nanomaterials, and their applications in various fields including electronics, energy, and biotechnology.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-75T-PCC-301– Introduction to nanotechnology	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-75T-PCC-301-Introduction to Nanotechnology

Unit-I

Emergence of Nanotechnology

- Schrödinger equation
- Electron confinement
- Tunneling of a particle through potential barrier
- Density of states (0D, 1D, 2D, 3D)

[7 Hours]

Unit-II

Synthesis of Nanomaterials

Physical methods:

- Introduction, mechanical methods, evaporation, sputter deposition, CVD, electric arc deposition, ion beam technique, nanolithography

Chemical methods:

- Introduction to colloids, nanoparticle growth, synthesis of metal and semiconductor nanoparticles by colloid route, L-B methods, microemulsions, Sol-Gel method

[8 Hours]

Unit-III

Characterization and Properties of Nanomaterials

- Structural characterization
- Chemical characterization
- Mechanical, optical, electrical, and magnetic properties

[7 Hours]

Unit-IV

Applications of Nanomaterials

- Nanotubes, catalysis of gold nanocrystals
- Band gap engineered quantum devices
- Carbon nanotube emitters
- Photoelectrochemical cells
- Biosensors

[8 Hours]

Suggested Reference Books:

1. Charles P. Poole Jr. et al. – Introduction to Nanotechnology, John Wiley & Sons (Asia) Pvt. Ltd.
2. Sulabha K. Kulkarni – Nanotechnology: Principles and Practices, Delhi
3. Guozhong Cao – Nanostructures and Nanomaterials: Synthesis, Properties and Applications, Imperial College Press, UK
4. Hari Singh Nalwa (Ed.) – Nanostructured Materials and Nanotechnology, Academic Press
5. M. Meyyappan and Mahendra K. Sunkara – Inorganic Nanowires, CRC Press

Course Learning Outcomes:

At the end of the course, students will be able to:

1. Understand the foundational concepts of nanotechnology and quantum confinement.
2. Compare and contrast different synthesis techniques for nanomaterials.
3. Analyse the structural and functional properties of nanomaterials.
4. Apply nanotechnology concepts in real-world devices and systems.

CCT-75T-PCC-302-Introduction to Nano-Electronics

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V	CCT-75T-PCC-302	Introduction to Nanoelectronics			7	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Advanced	PCC	02	-	02	Lectures	
Objectives of the Course:		To introduce the fundamental concepts and devices in nanoelectronics, covering topics from quantum confinement and tunnelling to single-electron transistors and molecular electronics.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-75T-PCC-302– Introduction to Nanoelectronics	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

Detailed Syllabus

CTG-501-Introduction to Nanoelectronics

Unit-I

Free and Confined Electrons:
Free electrons in 1D and 3D. Electrons confined to a bounded region of space and quantum numbers. Partially confined electrons in a finite potential well: finite rectangular well and parabolic (H.O.) well. Quantum dots, wires, and wells.

(7 hours)

Unit-II

Tunnel Junctions and their applications:
Tunnelling through a potential barrier; potential energy profiles for material interfaces between metal-insulator, metal-semiconductor, and metal-insulator-metal junctions; Application of tunnelling in field emission, double barrier tunnelling & Resonant Tunnelling Diodes.

(8 hours)

Unit-III

Coulomb Blockade:
Coulomb blockade in a nanocapacitor, tunnel junctions. Tunnel junction excited by a current source, Coulomb blockade in a quantum Dot Circuit.

(7 hours)

Unit-IV

The Single Electron Transistor:
Single-electron transistor and its logic. Carbon nanotube Transistor (FET and SET), Molecular SETs and Molecular Electronics.

(8 hours)

Suggested Reference Books:

1. Fundamentals of Nanoelectronics by George W. Hanson, Pearson Education
2. Introduction to Nanoelectronics: Science, Nanotechnology, Engineering and Applications by Vladimir V. Mitin et al., Cambridge University Press.

Course Outcomes:
At the end of the course, students will be able to:

1. Understand the fundamental quantum mechanical principles governing electron behaviour at the nanoscale.
2. Explain the concept of quantum tunnelling and its applications in nanoelectronics devices.
3. Describe the operation and applications of various tunnel junction-based devices.

4. Explain the working principles of single-electron transistors (SETs) and other advanced nanoelectronics devices. Develop a foundational understanding of key concepts and devices in nanoelectronics.

CCT-75T-PCC-303-Recombinant DNA Technology and Genetic Engineering

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V	CCT-75T-PCC-303	Recombinant DNA Technology and Genetic Engineering			7	2
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Advanced	PCC	2	-	2	30 Lectures	
Objectives of the Course:		• To understand the fundamental concepts of recombinant DNA technology, including gene cloning and DNA analysis. • To gain knowledge of various cloning vectors and techniques for DNA isolation, manipulation, and introduction into host cells. • To develop practical understanding of molecular biology tools such as PCR, gel electrophoresis, and their applications in gene and protein analysis. • To explore the principles of gene expression, transgenic animal and plant development, and their significance in biotechnology. • To acquire foundational skills in genetic engineering techniques, including gene transfer, tissue culture, and cloning technologies in animals and plants.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-75T-PCC-303-Recombinant DNA Technology and Genetic Engineering	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

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Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-75T-PCC-303-Recombinant DNA Technology and Genetic Engineering

Unit-I

Introduction to recombinant DNA technology: Importance of gene cloning and DNA analysis.
Enzymes in rDNA technology: Restriction endonucleases, DNA ligases, polymerases.
Cloning vectors: Plasmids, bacteriophages, cosmids, BACs, YACs. Purification of DNA from living cells, manipulation of purified DNA, introduction of DNA into living cells.

Unit-II

Principle, methodology, and applications of Polymerase Chain Reaction (PCR), Gel electrophoresis techniques for nucleic acids (agarose gel) and proteins (SDS-PAGE)
Studying gene expression and function, Production of proteins from cloned genes, Gene cloning and DNA analysis in medicines, agriculture, forensic science and archaeology

Unit-III

Gene transfer to animal cells. Strategies for gene transfer. Physical transfection techniques (electroporation and ultra sound). Selectable markers for the identification of successfully modified animal cells
Genetic manipulation of animals. Production of transgenic mice. Embryonic Stem cells for gene targeting in mice. Applications of genetically modified mice.

Unit-IV

Nuclear transfer technology and animal cloning, Gene transfer in Xenopus Oocytes, Fish and Drosophila.
Gene Transfer to plants. Plant tissue culture techniques callus culture, protoplast culture. Regeneration of fertile plant-organogenesis and embryogenesis.

Recommended Books:

1. Molecular Biology of the Gene – James D. Watson et al.
2. Molecular Cloning: A Laboratory Manual – Michael R. Green and Joseph Sambrook
3. PCR Technology: Current Innovations – Tania Nolan, Stephen A. Bustin
4. Gene Cloning and DNA Analysis: An Introduction – T.A. Brown
5. Genetic Engineering: Principles and Practice – Sandhya Mitra
6. Plant Biotechnology: The Genetic Manipulation of Plants – Adrian Slater, Nigel Scott, Mark Fowler
7. Biotechnology: Expanding Horizons – B.D. Singh

Course Learning Outcomes:

1. Define and understand key concepts of recombinant DNA technology, gene cloning, and DNA analysis in both theoretical and practical contexts.
2. Analyze the role and application of cloning vectors, restriction enzymes, and molecular techniques in gene manipulation.
3. Demonstrate proficiency in performing and interpreting basic molecular biology techniques such as PCR, gel electrophoresis, and DNA transformation.
4. Understand and explain the principles behind gene expression studies, transgenic animal models, and plant genetic engineering.
5. Apply knowledge of genetic engineering in practical fields such as medicine, agriculture, and biotechnology, and evaluate ethical considerations in modern biosciences.

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CCT-75T-PCC-304 Introduction to Bioinformatics

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V	CCT-75T-PCC-304	Introduction to Bioinformatics			7	2
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Advanced	PCC	2	-	2	30 Lectures	
Objectives of the Course:		1. To understand the basics, scope, and applications of bioinformatics. 2. To learn about key biological databases and data retrieval systems. 3. To study sequence alignment techniques and similarity search tools. 4. To explore protein structure analysis and prediction methods. 5. To introduce phylogenetic analysis and evolutionary study tools.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-75T-PCC-304– Introduction to Bioinformatics	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-75T-PCC-304-Introduction to Bioinformatics

Unit-I

Introduction to Bioinformatics and Biological Databases

- Introduction to Bioinformatics: History, scope, applications, use of Internet and World Wide Web.
- Bioinformatics Resources: Bibliographic databases, nucleotide and protein sequence databases, genome and structure databases, expression and proteomics databases, specialized databases, and metabolic pathway databases.
- Information Retrieval Systems: Entrez, SRS, NCBI, ExPASy, and Ensembl.
-

Unit-II

Sequence Analysis and Alignment Techniques

- Biological Sequences: DNA, RNA, and protein sequences; sequence formats (FASTA, GenBank, GCG).
- Sequence Alignment: Concepts of local and global alignment, pairwise and multiple sequence alignment (MSA), significance of alignment.
- Alignment Algorithms: Dot plot, dot matrix, dynamic programming (Needleman-Wunsch), scoring matrices (PAM, BLOSUM), and gap penalties.
- Search Tools: Heuristic approaches, BLAST (BLASTn, BLASTp, PSI-BLAST, PHI-BLAST), FASTA; domain and motif searching.

Unit-III

Protein Structure Analysis and Prediction

- Protein Structure: Levels of protein structure, supersecondary structures, structure-based classification.
- Structure Prediction: Secondary (Chou-Fasman, GOR, SOPMA), tertiary (homology modeling, neural networks), and transmembrane predictions.
- Protein Structure Databases: PDB, CATH, SCOP.
- Structural Bioinformatics Tools: VAST, DALI; STRING; RasMol; motif analysis.
-

Unit-IV

Phylogenetics and Evolutionary Analysis

- Phylogenetic Concepts: Types of phylogenetic trees (rooted, unrooted, bifurcating), molecular vs species phylogeny.
- Tree Construction Methods: Distance-based, character-based, parsimony methods.
- Tools for Phylogenetic Analysis: ClustalW, MEGA, iTOL.
- Applications in molecular evolution and functional genomics.

Course Learning Outcomes:

1. Identify and describe major bioinformatics databases and tools used in biological data analysis.
2. Perform sequence alignment and interpret results using tools like BLAST and FASTA.
3. Analyze and predict protein structures using basic computational approaches.
4. Apply knowledge of bioinformatics in phylogenetic tree construction and evolutionary studies.
5. Demonstrate understanding of bioinformatics applications in genomics, proteomics, and structural biology.

Recommended Books:

1. Bioinformatics: Principles and Applications – Ghosh & Mallick, Oxford University Press
2. Fundamentals of Bioinformatics and Computational Biology – Gautam B. Singh, Springer
3. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins – Andreas D. Baxevanis& B.F. Francis Ouellette, Wiley-Interscience
4. Essential Bioinformatics – Jin Xiong, Cambridge University Press
5. Introduction to Bioinformatics – Arthur M. Lesk, Oxford University Press

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CCT-75T-PCC-305-Artificial Intelligence

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V	CCT-75T-PCC-305	Artificial Intelligence			7	2
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Advanced	PCC	2	-	2	Lectures	
Objectives of the Course:		This course aims to introduce the basic concepts of Artificial Intelligence highlighting its importance. Main objectives of this paper are: • To impart basic knowledge about Artificial Intelligence • To learn the methods of solving problems using Artificial Intelligence • To learn to represent knowledge in solving AI problems				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-75T-PCC-305– Artificial Intelligence	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-75T-PCC-305-Artificial Intelligence

Unit-I

Introduction: What is Al?, the Turning Test approach, the cognitive modelling approach, the "Laws of thought" Approach add the rational agent approach, the foundations of Artificial Intelligence **Intelligent Agents:** Agents and Environments, Good Behaviour. The concept of Rationality, Performance measures. Rationality. Omniscience, learning, and autonomy. Nature of Environments, the tusk environment, structure of agents, agent programs, simple reflex agents, Model based reflex agents, Goal-based agents. Utility based agents, Learning agents.

[7 Hours]

Unit-II

Solving Problems by Searching: Problem Solving Agents, Well defined problems and solutions, Formulating problems Toy problems, Real Word problems searching for Solutions, Measuring problems solving performance uniformed search strategies Breadth-first search. Uniform-cost search. Depth-first search, Depth-limited search Iterative deepening depth first search, Bidirectional search Comparing uninformed search strategies

Informed search and Exploration: Informed (Heuristic) search Strategies, Greedy best-first search, A* search: inventing admissible heuristic functions, Learning heuristic from experience, Local Search Algorithms and Optimization Problems, Hill-climbing search, Simulated annealing search, Local beam search, Genetic algorithms

[8 Hours]

Unit-II

Constraint Satisfaction Problems: Constraint Satisfaction Problems. Backtracking Search for CS Variable and value ordering, Propagating information through constraints Forward checking, Constraints propagation. Handling special constraints

Adversarial Search: Optimal Decisions in Games. Optimal strategies the minimax algorithm, optimal decisions in multiplayer games, Alpha-Beta Pruning.

[7 Hours]

Unit-IV

Logic Agents: Knowledge-Based Agents, Wumpus World, Propositional Logic, Reasoning Patterns in Propositional Logic. Effective propositional inference, A complete backtracking algorithm, Local search algorithms. First-Order Logic: Syntax and Semantics of First-Order Logic, Models for first-order logic, Atomic sentences, Complex Sentences, Quantifiers. Universal quantification. existential quantification, nested quantifiers, Connections between For all and Exists Using First Order Logic Assertions and queries in first-order logic.

Inference in first-order logic: Propositional vs. First Order Inference, Inference rules for Quantifiers, Reduction to propositional reference, Unification and Lifting. A first-order inference rule. Unification. Storage and retrieval, Forward Chanting First order definite

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clauses, a simple forward-chaining algorithm. Resolution, Conjunctive normal form for first-order logic, the resolution inference rule, Completeness of resolution.

[8 Hours]

Suggested reference books:

1. Stuart Russell and Peter Norvig - Artificial Intelligence: A Modern Approach, Prentice Hall of India Pvt. Limited

2. Kevin Night and Elaine Rich, Nair B., ―Artificial Intelligence (SIE)‖, Mc Graw Hill-2008.

3. Dan W. Patterson - Introduction to Artificial Intelligence and Expert Systems, PHI, New Delhi, 2006.

Course Learning Outcomes:

This course provides a comprehensive understanding of the principles, techniques, and applications of AI.

At the end of the course, students will be able to :

1. Understand the fundamental concepts of Artificial Intelligence
2. Understand the concept of intelligent agents
3. Learn problem-solving techniques in AI
4. Understand the concept of constraint satisfaction problem and game playing
5. Get the insight of first-order logic for knowledge representation and represent a problem using first-order and predicate logic

CCT-75T-PCC-306-Functional Programming Language

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V	CCT-75T-PCC-306	Functional Programming Language			7	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Advanced	PCC	02	-	02	Lectures	
Objectives of the Course:		This course aims to introduce the fundamental concepts of Functional Programming Languages like scripts, functions, data types, and Numbers. It introduces Lists, Infinite List & Trees as fundamental data types. It discusses the way of increasing the efficiency of functional programming using different methods. It also explains the idea of ADT, Monads & parsing.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-75T-PCC-306– Functional Programming Language	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-75T-PCC-306-Functional Programming Language

Unit-I

Fundamental Concepts: Sessions and scripts, evaluations, values, function, definitions, types, specifications.
Simple Date Types: Booleans, Characters, Enumerations, Tuples, Other types Type, Synonyms, Strings
Numbers: Natural Numbers, Induction, Fold Function, Haskell numbers and examples: The rational, liner and binary search, Church numbers

[8 Hours]

Unit-II

Lists: Notations, basic operations, map and filter, Zip, the Fold functions, laws of Folds
Trees: Binary trees, Binary search trees, Binary heap trees, Rose trees.

[7 Hours]

Unit-III

Efficiency: Lazy evaluations, Asymptotic analysis, Accumulating parameters, Tupling Controlling space, Fusion, finite differencing and deforestation.
Abstract Date Types: Modules, Sets, Bags, Flexible arrays, Queues.

[8 Hours]

Unit-IV

Infinite lists: Infinite lists as limits, properties of infinite lists, cyclic structures
Monads: Monadic interaction, Variations on an evaluator, Monad laws, combining monads
Parsing: Sequencing, Alteration Repetition, Efficiency

[7 Hours]

Suggested reference book:
Richard Bird - Introduction to Functional Programming, Prentice Hall of India Pvt Ltd, New Delhi-2008

Suggested E-resources:

1. **https://discourse.haskell.org/t/haskell-the-craft-of-functional-programming-pdf/5718**
2. **https://www.haskell.org/**

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3. https://learnyouahaskell.com/introduction

Course Learning outcomes:

At the end of the course, students will be able to:

1. Explain the fundamental concepts of Functional Programming.
2. Write scripts for different concepts using function definitions.
3. Know the methods of saving space and time complexity of scripts.
4. Understanding the concepts of data types & abstract data types along with Monads & parsing.

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CCT-75T-PCC-307-Introduction to Cognitive Science

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V	CCT-75T-PCC-307	Introduction to Cognitive Science			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Advanced	PCC	02	-	02	30 Lectures, including diagnostic and formative assessments	
Objectives of the Course:		3. To understand the meaning, goals, history and different methods of Cognitive Science. 4. To gain an understanding of the meaning, nature and theories of representation and computation. 5. To learn about the interdisciplinary relevance of cognitive science. 6. To comprehend the multiple approaches of cognitive science and cognitive development.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-75T-PCC-307– Introduction to Cognitive Science	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

Detailed Syllabus

CCT-75T-PCC-307-Introduction to Cognitive Science

Unit-I

Introduction and Interdisciplinary relevance: Cognition: Beginning Concepts, Historical and Futuristic perspectives of Cognitive science; Relationship with psychology, philosophy, neuroscience, linguistics, anthropology, computer Science, sociology and biology.
(08 Lectures)

Unit-II

Multiple Approaches and Research Methods in Cognitive Science: Representation and Types of representation: Logic, Rules, Concepts, Analogies, Images, Connections; Computation, Tri-level hypothesis; Differing views on representation and computation; Research methods in cognitive science.

(07 Lectures)

Unit-III

Consciousness and Cognitive Development: Consciousness as a scientific construct, kinds, aspects and theories of consciousness. Life span development, Piagetian perspective, Core knowledge perspective, Vygotskyian perspective, Information processing perspective.
(07 Lectures)

Unit-IV

Emotional and Social Approaches: Emotion-Cognition interactions: Emotion and perception, memory, decision making and reasoning. Emotion and Neuroscience: Chemical and electrical basis of emotional computation. Social Cognitive Neuroscience: Evolution, attention and Mirror neurons. Attitudes and Cognitive dissonance. Dual process model of impression formation. Attribution and cognitive processes.

(08 Lectures)

Suggested Books and References:

6. Thagard P. (2005) Mind: Introduction to Cognitive Science. MIT Press
7. Kolak, D. et al (2006) Cognitive Science: an introduction to Mind & brain, Routledge Publication.
8. Solso R L. (2001) Cognitive Psychology Delhi Pearson Education
9. Berk, L. E. (2003) Child Development, Delhi, Pearson Education

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10. Matlin, M. W. (2002) Cognition, USA, Wadsworth, Thomson Learning
11. Friedenberg, J D; Silverman, G W & Spivey, M J (2022) Cognitive Science: An Introduction to the Study of Mind. New Delhi, Sage Publications

Course Learning Outcomes:

By the end of the Course, Students will be able to:

5. Develop an understanding of the epistemology of Cognitive science and analyze its tools and methods.
6. Analyze and understand the concepts and theories of representation and computation.
7. Comprehend the interdisciplinary nature of cognitive science.
8. Develop an understanding of different approaches to cognitive science.

CCT-75T-PCC-308-Introduction to Neuroscience

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
V	CCT-75T-PCC-308	Introduction to Neuroscience				7	02
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Advanced	PCC	02	-	02	No	30 Lectures, including diagnostic and formative assessments	
Objectives of the Course:		1. To identify the cellular and anatomical components of the nervous system and describe the fundamental electrical and chemical processes of neural communication. 2. To explain the neural pathways and mechanisms underlying sensory perception and motor control. 3. To analyse the developmental processes that shape the nervous system and evaluate how experience and intrinsic factors contribute to neural plasticity. 4. To discuss the neural substrates of higher cognitive functions and their relevance to behaviour and conscious experience.					

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-75T-PCC-308– Introduction to Neuroscience	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-75T-PCC-308-Introduction to Neuroscience

Unit-I

Fundamentals of Neural Structure and Function: Introduction, History of Neuroscience; Cellular components: neurons and glia (structure, types, and functions); Electrical signals: membrane potential, action potentials, ion channels; Synaptic transmission: neurotransmitters, receptors, postsynaptic potentials, synaptic integration; Basic neuroanatomy: major brain subdivisions, spinal cord, meninges, ventricular system.

(08 Lectures)

Unit-II

Sensory and Motor Systems: Fundamentals of sensory systems: Visual system (anatomy, visual coding and central visual pathways, Auditory system (anatomy, auditory coding and major auditory pathways), Somatosensory system (touch, proprioception, pain, temperature), Chemical senses (taste, olfaction); Fundamentals of motor systems: Organization of motor system, cortical areas, spinal cord and major motor pathways, role of Basel ganglia and cerebellum.

(07 Lectures)

Unit-III

Neural Development and Plasticity: Early brain development: gastrulation, neurulation, major brain subdivisions, neuronal migration; Construction of neural circuits: axon guidance, synapse formation, trophic interactions; Modification of brain circuits by experience: critical periods, visual system development, language development; Plasticity of mature synapses and circuits: LTP, LTD, adult neurogenesis.

(08 Lectures)

Unit-IV

Complex Brain Functions: Cognitive functions and cortical organization: Attention, Memory, Language and communication; Emotion, reward, motivation and addiction; Thinking planning and decision making; Introduction to consciousness, cortical states, sleep, dreaming and wakefulness.

(07 Lectures)

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Suggested Books and References:

- Purves, D., Augustine, G. J., Fitzpatrick, D., LaMantia, A.-S., White, L. E., & Williams, S. M. (2023). Neuroscience (7th ed.). Oxford University Press.
- Kandel, E. R., Schwartz, J. H., Jessell, T. M., Siegelbaum, S. A., & Hudspeth, A. J. (2021). Principles of Neural Science (6th ed.). McGraw-Hill Education.
- Squire, L. R., Berg, D., Bloom, F. E., du Lac, S., Ghosh, A., & Spitzer, N. C. (2012). Fundamental Neuroscience (4th ed.). Academic Press.
- Bear, M. F., Connors, B. W., & Paradiso, M. A. (Latest Edition). Neuroscience: Exploring the Brain. Lippincott Williams & Wilkins.
- Nicholls, J. G., Martin, A. R., Wallace, B. G., & Fuchs, P. A. (Latest Edition). From Neuron to Brain. Sinauer Associates.

Course Learning Outcomes:

By the end of the Course, Students will be able to:

1. Describe the fundamental cellular and molecular components of the nervous system and articulate their specific roles in neural signalling processes, including the generation of action potentials, synaptic transmission, and the function of various neurotransmitters.
2. Explain the anatomical organization and functional mechanisms of major sensory and motor systems, detailing their neural pathways and the processes by which information is encoded and processed.
3. Analyse the intricate processes of nervous system development, including neural circuit formation, and evaluate how experience-dependent plasticity modifies these circuits throughout life.
4. Discuss the neural bases of complex brain functions such as memory, attention, language, and emotion, and articulate their implications for understanding human and animal behaviour

CCT-75P-PCC-321-Nano Synthesis Laboratory

Semester	Code of the Course	Title of the Course/Paper			NHEQ F Level	Credits
V	CCT-75P-PCC-321	Nano Synthesis lab			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Advanced	PCC	-	02	02	PRACTICAL	
Objectives of the Course:		• To introduce synthesis techniques for nanomaterials using physical and chemical routes. • To demonstrate basic lab methods like sol-gel synthesis, co-precipitation, and thin-film deposition. • To study optical and magnetic properties through simple characterization methods.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Practical	CCT-75P-PCC-321–Nano Synthesis lab	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for **Nano Synthesis lab** should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-75P-PCC-321-Nano Synthesis Laboratory

List of Experiments

1. Synthesis of Silver Nanoparticles (Green Method)
2. Synthesis of ZnO Nanoparticles (Sol-Gel Method)
3. Synthesis of Fe_3O_4 Nanoparticles (Co-precipitation)
4. Precipitation Synthesis of CuO Nanoparticles
5. Spin Coating of ZnO Nanoparticles on Glass
6. UV-Visible Spectroscopy of Nanoparticles
7. Ball Milling Demonstration (Top-down Approach)
8. Application Study: Nanoparticles in Sunscreens

References

1. C.N.R. Rao – *The Chemistry of Nanomaterials*, Wiley-VCH
2. G. Cao – *Nanostructures and Nanomaterials*, Imperial College Press
3. T. Pradeep – *A Textbook of Nanoscience and Nanotechnology*, McGraw Hill
4. Relevant research papers and institutional lab manuals

Course Learning Outcomes

1. Isolate genomic and plasmid DNA from microbes.
2. Perform restriction digestion and gel electrophoresis.
3. Conduct bacterial transformation using plasmids.
4. Amplify DNA using PCR technique.
5. Visualize DNA, proteins, and GFP expression in lab setups.

CCT-75P-PCC-323-Functional Programming Language Lab

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V	CCT-75P-PCC-323	Functional Programming Language Lab			5	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
100-199	Major	-	02	02	60 Hours of lab	
Objectives of the Course:		By the end of the course, students should: 1. Understand the fundamental concepts and principles of functional programming and its application in problem-solving. 2. Develop skills in writing functional programs using recursion, higher-order functions, and data abstraction. 3. Implement algorithms using functional programming paradigms for mathematical, string, and list operations. 4. Apply functional programming constructs to design efficient, reusable, and modular solutions to computational problems.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Practical	CCT-75P-PCC-323– Functional Programming Language Lab	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for **Functional Programming Language Lab** should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-75T-PCC-323-Functional Programming Language Lab

1. Write a functional program for implementing arithmetic operations for Integers, Floating numbers & Num class.
2. Write a functional program for the following functions for the char class: isDigit, isUpper, isLower,toUpper, toLower
3. Write a functional program for implementing the enumerated data type Day, Triangle with functions.
4. Write a recursive functional program(simple, conditional, guraded, main) for implementing: Factorial, GCD, Fibonacci
5. a function to find Pythagorean triods (x,y,z) such that $x^2+y^2=z^2$
6. Write currying and uncurrying functions: Smaller/smallerc, Plus/plusc
7. Write a functional definition for the following(conditional, guarded) :Max/Min of 3 numbers, Root of a Quadratic equation
8. Write a functional definition for the reverse of the number & sum of digits.
9. Write a functional definition for prime number computation: isPrime, firstNPrime firstNPrimeinRange
10. Write a functional definition for list, linear search, binary search, quicksort, and mergesort

Suggested reference book:

1. Richard Bird - Introduction to Functional Programming, Prentice Hall of India Pvt Ltd, New Delhi-2008

Suggested E-resources:

1. **https://discourse.haskell.org/t/haskell-the-craft-of-functional-programming-pdf/5718**
2. **https://www.haskell.org/**
3. **https://learnyouahaskell.com/introduction**

Course Learning Outcomes:

By the end of the Course, Students will be able to:
After successful completion, students will be able to:

1. Write functional programs to perform arithmetic, string, and character operations using built-in and user-defined functions.
2. Implement recursive algorithms for mathematical computations (e.g., factorial, Fibonacci, GCD) and problem-specific logic (e.g., Pythagorean triples).
3. Apply functional programming techniques such as currying, guarded expressions, and conditional definitions in solving real-world problems.

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4. Develop and test functional programs to handle searching and sorting operations using list-based data structures.

CCT-75F-MC-301-Anandam-III

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V	CCT-75F-MC-301	Anandam-III			7	00
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	MC	-	00	00	60 Hours Field Activity	
Objectives of the Course:		Students are expected to engage in – 8. An individual act of goodness, caring, sharing and giving (time and energy) every day 9. Group activity – a project in service of the local community (Group Community Service Project) 10. 3. Apply their knowledge and skills to solve specific community problem 11. Learn to plan, lead and organise community events. 12. Have a sense of belonging to their college campus and community and find something they are interested in doing in their free time. 13. Make new friends, expand social network, and boost social skills and mental health. 14. Be useful to society as it will protect them against stress, frustration and depression				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Practical	CCT-75F-MC-301–Anandam-III	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

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SEMESTER-WISE PAPER TITLES WITH DETAILS

DD0401 – Dual Degree B.Tech.-M.Tech. in Converging Technologies VI-Semester							
#	Semester	Type	Title	Credits			
				L	T	P	Total
14.	VI	HSMC	HSMC Elective 2	2	0	0	**2**
15.	VI	PCC	CCT-76T-PCC-309-Synthesis and Characterization of Nanomaterials	2	0	0	**2**
16.	VI	PCC	CCT-76T-PCC-310-Nano-Photonics	2	0	0	**2**
17.	VI	PCC	CCT-76T-PCC-311-Metabolic Engineering	2	0	0	**2**
18.	VI	PCC	CCT-76T-PCC-312-Omics Science	2	0	0	**2**
19.	VI	PCC	CCT-76T-PCC-313-Basic of Quantum Computing	2	0	0	**2**
20.	VI	PCC	CCT-76T-PCC-314-Transmission Control Protocol / Internet Protocol	2	0	0	**2**
21.	VI	PCC	CCT-76T-PCC-315-Cognitive Neurology	2	0	0	**2**
22.	VI	PCC	CCT-76T-PCC-316-Brain Mapping & Engineering	2	0	0	**2**
23.	VI	PCC	CCT-76P-PCC-324-Nanomaterial Synthesis Lab	0	0	2	**2**
24.	VI	PCC	CCT-76P-PCC-325-Bioinformatics Lab	0	0	2	**2**
25.	VI	PCC	CCT-76P-PCC-326-MATLAB/SCILAB Programming Lab	0	0	2	**2**
26.	VI	MC	CCT-76F-MC-302-Indian Knowledge System	0	0	0	**0**
				18	**0**	**06**	**24**

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CCT-76T-PCC-309-Synthesis and Characterization of Nanomaterials

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
VI	CCT-76T-PCC-309	Synthesis and Characterization of Nanomaterials			7	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Advanced	PCC	02	-	02	Lectures	
Objectives of the Course:		This course aims to provide an understanding of the synthesis methods and characterization techniques for nanomaterials. It will cover both homogeneous and heterogeneous nucleation, various synthesis approaches, electron microscopy, scanning probe microscopy, and optical and magnetic properties of nanomaterials.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-76T-PCC-309-Synthesis and Characterization of Nanomaterials	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-76T-PCC-309-Synthesis and Characterization of Nanomaterials

Unit-I

Physical Property of Solid Surface

- Surface energy, Chemical potential as a function of surface curvature.
- Electrostatic stabilization, Surface charge density, Electric potential at the proximity of solid surface.
- Van der Waals attraction potential, Interactions between two particles: DLVO theory.

(6 Hours)

Unit-II

Nanoparticles: Homogeneous and Heterogeneous Nucleation

- Fundamentals of Homogeneous Nucleation, Growth of nuclei controlled by diffusion and surface process, synthesis of metallic, semiconductors and oxide nanoparticles.
- Fundamentals of Heterogeneous nucleation, synthesis of nanoparticles, kinetically confined synthesis of nanoparticles (microemulsions, aerosol, growth termination, spray pyrolysis, template-based synthesis).

(9 Hours)

Unit-III

Transmission Electron Microscopy and Scanning Probe Microscopy of Nanoparticle

- **Transmission Electron Microscopy (TEM) / High Resolution TEM (HRTEM):** Lattice imaging (Image formation, Contrast mechanisms, Image interpretation, Image simulation).
- **Scanning Probe Microscopy:** Fundamentals of the techniques, Experimental approaches and data interpretation (Scanning Tunneling Microscopy (STM) / Scanning Tunneling Spectroscopy (STS), Scanning Force Microscopy (SFM), Scanning near-field microscopy (SNOM)).

(7 Hours)

Unit-IV

Optical Spectroscopy of Nanophase Material and Magnetic properties of Nanomaterial Experimental, Metal nanostructures (Size and shape dependence of the Plasmon absorption on gold nanoparticles), Electron dynamics in gold nanoparticles), Semiconductor nanostructures (CdS quantum dots and interfacial charge transfer dynamics, Core - shell hetero nanostructures: CdS nanoparticles capped with Cd(OH)2 ,CdS nanoparticles capped with ZnS, CdS nanoparticles capped with an outer CdS cladding).

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Origin of magnetism. Single domain versus multi-domain behaviour, Coercivity of nanoparticles. Superparamagnetism in nanomaterials, Magnetic anisotropy energy.

(8 Hours)

Suggested Reference Books:

1. "Intermolecular and Surface Forces" by Jacob N. Israelachvili
2. "Principles of Colloid and Surface Chemistry" by Paul C. Hiemenz and Raj Rajagopalan
3. "Nanoscale Materials" by Kenneth J. Klabunde and Ronald M. Richards
4. "Nanochemistry: A Chemical Approach to Nanomaterials" by Geoffrey A. Ozin and André C. Arsenault
5. "Transmission Electron Microscopy: A Textbook for Materials Science" by David B. Williams and Clyde B. Carter
6. "Electron Microscopy: Principles and Techniques" by Martha J. Burek
7. "Scanning Tunneling Microscopy and Spectroscopy: Theory, Techniques, and Applications" by David A. Bonnell
8. "Atomic Force Microscopy" by Peter Eaton and Paul West
9. "Optical Properties of Metal Clusters" by Walter A. de Heer
10. "Quantum Dots: Optics, Electron Transport, and Future Applications" by Alexander L. Efros
11. "Nanomagnetism: An Introduction" by David J. Sellmyer and Rong-Chau (Rocky) Cammarata

Course Learning Outcomes:

At the end of the course, students will be able to:

1. Understand the fundamental physical properties of solid surfaces relevant to nanomaterial synthesis.
2. Explain the mechanisms of homogeneous and heterogeneous nucleation and various methods for synthesizing nanoparticles.
3. Describe the principles and applications of transmission electron microscopy and scanning probe microscopy techniques for nanomaterial characterization.
4. Analyse the optical and magnetic properties of nanomaterials and their dependence on size, shape, and composition.

CCT-76T-PCC-310-Nano-Photonics

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
VI	CCT-76T-PCC-310	Nano-Photonics			7	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Advanced	PCC	02	-	02	Lectures	
Objectives of the Course:		"This course aims to introduce the fundamental principles of nanophotonics, covering the behavior of light and matter at the nanoscale. It will explore quantum-confined materials, photonic crystals, and applications of nanophotonics in biotechnology and nanomedicine."				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-76T-PCC-310-Nano-Photonics	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-76T-PCC-310-Nano-Photonics

Unit-I

Foundations for Nanophotonics

- Photons and Electrons: Similarities and Differences: Free-Space Propagation.
- Confinement of Photons and Electrons, Propagation Through a Classically Forbidden Zone: Tunneling.
- Localization Under a Periodic Potential: Bandgap.
- Cooperative Effects for Photons and Electrons, Nanoscale Optical Interactions: Axial Nanoscopic Localization, Lateral Nanoscopic Localization.

[7 Hours]

Unit-II

Quantum-Confined Materials

- Quantum Wells, Quantum Wires, Quantum Dots, Quantum Rings.
- Manifestations of Quantum Confinement: Optical Properties, Examples.
- Quantum-Confined Stark Effect, Dielectric Confinement Effect, Quantum-Confined Structures as Lasing Media.

[8 Hours]

Unit-III

Photonic Crystals

- Basic Concepts, Theoretical Modeling, Features, Methods of Fabrication.
- Photonic Crystal Optical Circuitry, Nonlinear Photonic Crystal, Photonic Crystal Fibers, Photonic Crystal and Optical Communications, Photonic Crystal Sensors.

[8 Hours]

Unit-IV

Nanophotonics for Biotechnology and Nanomedicine

- Near-Field Bioimaging, Nanoparticles for Optical Diagnostics and Targeted Therapy.
- Semiconductor Quantum Dots for Bioimaging, Up-Converting Nanopores for Bioimaging, Biosensing, Nano clinics for Optical Diagnostics and Targeted Therapy.
- Nano clinic Gene Delivery, Nano clinics for Photodynamic Therapy.

[7 Hours]

Reference Books:

- Nanophotonics - Paras N. Prasad Wiley Inter Science 2004
- Nanophotonics - Edited by HericeRigneault, Jean-Michal Lourtiriz, Claude Delalance, Ariel Levenson ISTE.

Course Learning Outcomes:

At the end of the course, students will be able to:

1. Explain the fundamental principles of nanophotonics and the behavior of light and matter at the nanoscale.
2. Analyze the properties and applications of quantum-confined materials.
3. Describe the principles and applications of photonic crystals in various optical technologies.
4. Evaluate the applications of nanophotonics in biotechnology and nanomedicine.

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CCT-76T-PCC-311 Metabolic Engineering

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
VI	CCT-76T-PCC-311	Metabolic Engineering			7	2
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Advanced	PCC	2	-	2	30 Lectures	
Objectives of the Course:		1. Understand the core concepts and importance of metabolic engineering in biotechnology. 2. Learn key biochemical pathways and cellular metabolism. 3. Study enzyme and genetic regulation of biosynthetic processes. 4. Explore tools for pathway modeling and metabolic flux analysis. 5. Apply metabolic engineering in real-world industrial and environmental contexts.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-76T-PCC-311-Metabolic Engineering	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-76T-PCC-311 Metabolic Engineering

Unit-I

Introduction and Cellular Metabolism

Introduction to Metabolic Engineering: Importance, scope, and industrial relevance.
Overview of Cellular Metabolism: Cellular networks, transport processes (passive, facilitated diffusion, active transport), polymerization processes, and growth energetics.
Fueling Reactions: Glycolysis, fermentative pathways, TCA cycle, oxidative phosphorylation, anaplerotic reactions, catabolism of fats, organic acids, and amino acids.

Unit-II

Biosynthesis and Metabolic Regulation

Biosynthetic Pathways: Biosynthesis of amino acids, nucleotides, fatty acids, and other cellular building blocks.
Comprehensive Models for Cellular Reactions: Stoichiometry, reaction kinetics, dynamic mass balances, yield coefficients, and linear rate equations.
Regulation of Metabolic Pathways: Enzyme kinetics, inhibition, allosteric control, regulation of enzyme concentration (transcription and translation),

Unit-III

Tools and Analysis in Metabolic Engineering

Global Metabolic Regulation and Network Control: Global metabolic regulation, network control (branch points, coupled reactions, currency metabolites).
Metabolic Pathway Synthesis: Pathway design algorithms, case study on lysine biosynthesis, constraints and yield optimization.
Metabolic Flux Analysis (MFA): Concepts, modeling overdetermined and underdetermined systems, linear programming, sensitivity analysis.

Unit-IV

Applications and Case Studies

Practical Applications of Metabolic Engineering:

- Product yield and productivity enhancement (ethanol, amino acids, solvents)
- Substrate range expansion (pentoses, cellulose, lactose, sucrose)
- Novel product synthesis (antibiotics, polyketides, vitamins, biopolymers, pigments, hydrogen)
- Optimization of cellular traits (oxygen use, nitrogen metabolism, overflow prevention, genetic stability)

- Xenobiotic degradation (PCBs, benzene, toluene, xylene)

Suggestive Reading

1. *Metabolic Engineering: Principles and Methodologies* by Stephanopoulos, Aristidou, and Nielsen
2. *Metabolic Engineering* edited by Lee and Papoutsakis
3. *Computational Analysis of Biochemical Systems* by Voit
4. *Bioreaction Engineering Principles* by Nielsen and Villadsen
5. *Systems Biology: Constraint-Based Reconstruction and Analysis*
6. *Biochemistry* by Stryer

Course Learning Outcomes

1. Explain the core principles of metabolic engineering and describe key metabolic and biosynthetic pathways.
2. Analyze and interpret enzyme regulation mechanisms and their roles in controlling cellular metabolism.
3. Apply stoichiometric and kinetic models to simulate and evaluate metabolic processes.
4. Use computational tools for metabolic pathway design and flux analysis to optimize product formation.
5. Evaluate and discuss practical applications of metabolic engineering in improving industrial yield, bioproduct diversity, and environmental sustainability.

CCT-76T-PCC-312-Omics Science

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
VI	CCT-76T-PCC-312	Omics Science			7	2
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Advanced	PCC	2	-	2	30 Lectures	
Objectives of the Course:		1. To provide foundational knowledge of genome structure, gene networks, and genome analysis methods. 2. To introduce techniques and tools used in proteomics and structural biology. 3. To develop understanding of transcriptomics, gene expression analysis, and microarray data interpretation. 4. To explore interactomics, protein-protein interactions, and principles of metabolomics. 5. To familiarize students with major biological databases and their applications in omics research.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-76T-PCC-312-Omics Science	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-76T-PCC-312-Omics Science

Unit-I

Genomics and Genome Analysis

- Introduction to genome and gene networks
- Gene prediction: genes, promoters, splice sites, regulatory regions
- Genome sequencing strategies and assembly
- Genome annotation and major genome projects (e.g., Human Genome Project)
- Genome databases of plants, animals, and pathogens
- Metagenomics: concept and applications

Unit-II

Proteomics and Structural Biology

- Concept of proteome and protein arrays
- Protein analysis techniques: PAGE (Native, SDS), Mass Spectrometry
- Structural analysis: X-ray crystallography, NMR
- Deriving protein function from sequence
- Applications of proteomics in drug discovery and toxicology

Unit-III

Transcriptomics and Gene Expression Analysis

- Basic tools and principles of transcriptomics
- DNA microarrays and interpretation of microarray data
- Differential gene expression and correlation with biological processes
- Computational tools for transcriptome analysis
- DNA microarray and transcriptomic databases: GEO, ArrayExpress, SAGE

Unit-IV

Interactomics and Metabolomics

- Protein–protein interaction: two-hybrid screening, immunoprecipitation
- Tools and databases for interactomics: STRING, DIP, PPI servers
- Nucleic acid–protein interactions and concept of epigenomics
- Nuclear receptors and orphan nuclear receptors
- Introduction to metabolomics and analytical technologies
- Metabolic pathway databases: EcoCyc, MetaCyc, LIGAND, ENZYME, BRENDA, KEGG
- Biological network structure and relevance in metabolic engineering

Suggestive Reading

1. **Principles of Genome Analysis and Genomics –** S.B. Primrose & R.M. Twyman
2. **Genomes**(3rd Edition) – T.A. Brown
3. **Bioinformatics: Sequence and Genome Analysis –** David W. Mount
4. **Introduction to Proteomics: Tools for the New Biology –** Daniel C. Liebler
5. **Proteomics: From Protein Sequence to Function –** S.R. Pennington & M.J. Dunn
6. **Transcriptomics: Methods and Applications –** P. Baldi & G.W. Hatfield
7. **Metabolomics: A Powerful Tool in Systems Biology –** Jens Nielsen & Michael C. Jewett

Course Learning Outcomes:

1. Understand genome organization, gene prediction methods, and genome sequencing approaches.
2. Apply basic techniques in proteomics and analyze protein structure and function.
3. Interpret transcriptomic data using microarrays and relevant bioinformatics tools.
4. Identify protein interactions and metabolic pathways using interactomic and metabolomic databases.
5. Integrate multi-omics data for understanding biological processes and systems-level analysis.

CCT-76T-PCC-313-Basic of Quantum Computing

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
VI	CCT-76T-PCC-313	Basic of Quantum Computing				7	02
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Advanced	PCC	02	-	02	No	Lectures	
Objectives of the Course:		To introduce the fundamentals of quantum computation, including quantum mechanics postulates, quantum gates, and algorithms. The course develops the ability to model and analyze simple quantum circuits, understand key algorithms, and explore various physical implementations of quantum computers.					

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-76T-PCC-313-Basic of Quantum Computing	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-76T-PCC-313-Basic of Quantum Computing

Unit-I

Linear algebra of matrix mechanics, Postulates of Quantum mechanics, superdense coding, density operator, Schmidt decomposition and purifications, EPR and the Bell inequality

[8 Hours]

Unit-II

Models for computation: Turing machines and Circuits; analysis of computational problems, Computational complexity, Idea of qubit, qubit operations: single qubit operations, controlled qubit operations, measurement, universal quantum gates, simulation of quantum systems

[7 Hours]

Unit-III

Quantum Algorithms: Deutsch Algorithm, Deutsch–Jozsa Algorithm, Simon's Algorithm, Shor's Algorithm, Grover's Algorithm

[7 Hours]

Unit-IV

Quantum computers: Conditions for quantum computation, Harmonic oscillator quantum computer, Optical photon quantum computer, Optical cavity quantum electrodynamics, Ion traps, Nuclear magnetic resonance.

[8 Hours]

Suggested reference books:

1. M.A. Nielsen and Isaac L. Chaung, Quantum Computation and Quantum Information, Cambridge University Press, 2010.
2. Eleanor Rieffel and Wolfgang Polak, Quantum Computing : A Gentle Introduction, MIT Press, 2011.
3. Phillip Kaye, Raymond Laflamme and Michele Mosca, An Introduction to Quantum Computing, Oxford University Press, 2007

Course outcomes: At the end of the course, the student will be able to:

1. Apply the postulates of quantum mechanics and mathematical tools (linear algebra, tensor products) to describe quantum systems.
2. Explain and analyze quantum information protocols (superdense coding, Bell inequality tests) using density matrix formalism.
3. Compare classical and quantum computation models and analyze computational complexity in the quantum framework.
4. Design and evaluate simple quantum circuits and implement key quantum algorithms.

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5. Describe the principles, working, and challenges of different physical realizations of quantum computers.

CCT-76T-PCC-314-Transmission Control Protocol / Internet Protocol

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
VI	CCT-76T-PCC-314	Transmission Control Protocol/Internet Protocol				7	02
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Advanced	PCC	02	-	02	No	Lectures	
Objectives of the Course:		• To provide a comprehensive understanding of the TCP/IP protocol suite, including its architecture, concepts, and key protocols. • To develop practical skills in socket programming using TCP and UDP for network communication. • To explore advanced socket programming techniques, including IPv4/IPv6 interoperability, non-blocking I/O, and multithreading. • To introduce interprocess communication (IPC) mechanisms, including POSIX IPC, System V IPC, and remote procedure calls (RPC).					

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-76T-PCC-314-Transmission Control Protocol/Internet Protocol	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

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PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

Detailed Syllabus

CCT-76T-PCC-314-Transmission Control Protocol / Internet Protocol

UNIT-I

Review of concepts and protocols in TCP/IP: Introduction, internet working, concepts and architecture, ARP, RARP, internet protocol (datagram delivery, routing, ICMP) HELLO, NAT, VPN, client server model, BOOTP, DHCP, NFS

[8 Hours]

UNIT-II

Socket Programming: Socket fundamentals, elementary TCP and UDP sockets, I/O multiplexing, socket options, elementary name and address conversion.

[7 Hours]

UNIT-III

Advanced Sockets: Introduction to (IPV6, IPV4 and IPV6) interoperability, advanced name and address conversion, daemon process and inetd, advanced 1/0 and non blocking 1/0 broadcasting, threads and IP options.

[8 Hours]

UNIT-IV

Advanced Topics: Interprocess communication introduction, POSIX IPC and system V IPC, introduction to pipes and FIFOS, doors and sun RPC (introduction only)

[7 Hours]

Reference Books:

1. Behrouz A. Forouzan, “Data Communication and Networking”, 4th edition, Tata McGraw Hill.
2. A. S. Tanenbaum, “Computer Networks”, Pearson Education Asia, 4th Ed.
3. William Stallings, “Data and computer communications”, Pearson education Asia, 7th Ed.
4. "Computer Networking: A Top-Down Approach" by James F.Kurose and Keith W.Ross.
5.

Suggested E-resources:

4. https://archive.nptel.ac.in/courses/106/106/106106243/
5. https://www.cisco.com/c/en/us/solutions/small-business/resource-center/networking/networking-basics.html

Course Learning Outcomes:

After successful completion of the course, the students are able to learn:

1. A clear understanding of TCP/IP architecture, addressing, routing, and associated protocols.
2. Develop and implement network applications using socket programming in TCP and UDP.
3. Utilize advanced socket programming techniques for efficient network communication and process management.
4. Apply IPC mechanisms for communication between processes.

CCT-76T-PCC-315-Cognitive Neurology

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
VI	CCT-76T-PCC-315	Cognitive Neurology				7	02
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Advanced	PCC	02	-	02	No	30 Lectures, including diagnostic and formative assessments	
Objectives of the Course:		1. To trace the historical development of cognitive neuroscience, identify key brain regions and their specialized functions, and understand the methodologies used to investigate brain-cognition relationships. 2. To learn basic cognitive assessments, recognize patterns of cognitive deficits, and describe common acquired cognitive disorders. 3. To differentiate between various neurodegenerative dementias and other causes of cognitive impairment based on clinical and pathological features. 4. To analyse complex and less common causes of cognitive impairment, understand the interplay between neurological and psychiatric conditions, and discuss emerging frontiers in cognitive neuroscience and neurotherapy.					

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-76T-PCC-315-Cognitive Neurology	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

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Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with internal choice. Each question will carry 8 marks.

Detailed Syllabus

CCT-76T-PCC-315-Cognitive Neurology

Unit-I

Foundations of Cognitive Neuroscience: Historical origins and emergence of cognitive neuroscience; Brain anatomy and functional specialization: frontal, temporal, parietal, occipital lobes, basal ganglia, white matter organization; Neurochemistry of cognition; Methods in cognitive neuroscience: EEG, MEG, fMRI, TMS, lesion studies, computational modelling.

(08 Lectures)

Unit-II

Neuropsychological and Cognitive Disorders: Principles and practice of neuropsychological assessment; Acquired disorders of language and speech (aphasia); Memory disorders (amnesia, types of memory deficits); Vision and visual processing deficits; Disorders of attentional processes; Apraxia and acquired calculation disorders; Disorders of reading and writing.

(07 Lectures)

Unit-III

Cognitive Neurology and Clinical Syndromes: Assessment and investigation of cognitively impaired adults; Alzheimer's disease: changing concepts, definitions, presentation, and management; Dementia: Frontotemporal dementia and primary progressive aphasia; Lewy body dementia and Parkinson's disease dementia; Vascular cognitive impairment and cerebral amyloid angiopathy.

(08 Lectures)

Unit-IV

Advancements in Clinical Cognitive Neuroscience: CNS infections and metabolic dementias affecting cognition; Inflammatory causes: multiple sclerosis, autoimmune encephalitis; Traumatic brain injury (TBI) and its cognitive sequelae; Neuropsychiatric

aspects of cognitive impairment: schizophrenia, bipolar disorder, depression; Recent trends: cognitive neuroscience and AI, neurotherapy.

(07 Lectures)

Suggested Books and References:

- Husain, M., & Schott, J. M. (Eds.). (2018). Oxford Textbook of Cognitive Neurology and Dementia. Oxford University Press.
- Gazzaniga, M. S., Mangun, G. R., & Poeppel, D. (Eds.). (2020). The Cognitive Neurosciences (6th ed.). MIT Press.
- Purves, D. et al. (2023). Neuroscience (7th ed.). Oxford University Press. (Relevant chapters on complex brain functions).

Course Learning Outcomes:

By the end of the Course, Students will be able to:

5. Evaluate the complex neural circuits and underlying mechanisms responsible for core cognitive functions such as memory, attention, language, and executive control.
6. Apply principles of neuropsychological assessment to effectively identify and characterize specific cognitive deficits that arise from brain lesions or various neurological diseases.
7. Diagnose common cognitive neurological syndromes, such as Alzheimer's disease, frontotemporal dementia, and aphasia, based on their characteristic clinical presentation, underlying neuropathology, and relevant neuroimaging findings.
8. Propose evidence-based management strategies for patients with cognitive neurological disorders and critically discuss the ethical considerations inherent in their diagnosis and treatment.

CCT-76T-PCC-316-Brain Mapping and Engineering

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
VI	CCT-76T-PCC-316	Brain Mapping and Engineering			7	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Advanced	PCC	02	-	02	30 Lectures, including diagnostic and formative assessments	
Objectives of the Course:		1. To explain the physical and biological bases of major neuroimaging techniques and compare their utility for different research questions. 2. To apply computational models to simulate neural activity and utilize statistical methods for analysing complex neuroimaging data. 3. To describe the principles and components of BCIs and neuro-prosthetics, and evaluate their therapeutic potential and associated ethical challenges. 4. To analyse cutting-edge neuro-engineering technologies and their potential impact on research, clinical practice, and the future of human-brain interaction.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-76T-PCC-316-Brain Mapping and Engineering	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-76T-PCC-316-Brain Mapping and Engineering

Unit-I

Principles of Neuroimaging Techniques: Overview of neuroimaging techniques, Electrophysiology (EEG, MEG), optical methods, calcium imaging; Functional Magnetic Resonance Imaging (fMRI): physical principles, BOLD response, data acquisition, experimental design; Positron Emission Tomography (PET): principles and applications; Structural imaging (MRI, DTI, VBM); Limitations and strengths of different neuroimaging modalities.

(08 Lectures)

Unit-II

Computational Neuroscience and Neural Modelling: Introduction to computational neuroscience: neural networks, information processing; Neural modelling: neuron models (e.g., Hodgkin-Huxley), network models, neural engineering framework (NEF); Data analysis methodologies: signal processing (EEG, fMRI), statistical parametric mapping (SPM), General linear model (GLM), multivariate analysis; Brain connectivity: functional and structural connectivity analysis.

(07 Lectures)

Unit-III

Brain-Computer Interfaces (BCIs) and Neuro-prosthetics: Introduction to BCIs: history, paradigms (classic, hybrid), signal acquisition methods; BCI components: signal processing, feature extraction, classification; Therapeutic applications: motor rehabilitation, communication, consciousness assessment; Human factors and ethical considerations in BCI design; Neuro-prosthetics: auditory, visual, motor prostheses.

(08 Lectures)

Unit-IV

Emerging Technologies and Applications in Neuro-engineering: Advanced neurostimulation techniques; Optogenetics for neural tissue engineering; Gene editing in neuroscience; Modelling with organ-on-a-chip systems; AI and machine learning in neuro-engineering; Future directions and interdisciplinary collaborations.

(07 Lectures)

Suggested Books and References:

1. Willerth, S. (Ed.). (2024). Handbook of Neural Engineering: A Modern Approach. Elsevier.
2. Terry, M., Tubbs, A., Dupre, B., Fugger, B., & Vasquez, E. A. (2024). Introduction to Neuroengineering. University of North Dakota.
3. Nam, C. S., Nijholt, A., & Lotte, F. (Eds.). (2018). Brain–Computer Interfaces Handbook: Technological and Theoretical Advances. CRC Press (Taylor & Francis).
4. Ashby, F. G. (2019). Statistical Analysis of fMRI Data (2nd ed.). MIT Press.
5. Toga, A. W. (Ed.). (2012). Brain Mapping: A Comprehensive Reference. Elsevier.
6. Cabeza, R., & Kingstone, A. (Eds.). (2024). Handbook of Functional Neuroimaging of Cognition (2nd ed.). MIT Press.
7. Chatterjee, I., &Moradikor, D. (Eds.). (2024). Integrating Neuroimaging, Computational Neuroscience, and Artificial Intelligence. Routledge.

Course Learning Outcomes:

By the end of the Course, Students will be able to:

1. Understand the physical and physiological principles that underpin various neuroimaging techniques (e.g., fMRI, EEG, MEG, PET) and critically evaluate their respective strengths and limitations for mapping brain structure and function.
2. Apply advanced computational and statistical methods for the rigorous analysis of neuroimaging data and neural signals, encompassing preprocessing techniques, the use of general linear models, and methods for assessing functional connectivity.
3. Design and critically evaluate the fundamental principles and diverse applications of Brain-Computer Interfaces (BCIs) and neuro-prosthetics, considering aspects of signal acquisition, processing algorithms, and associated ethical implications.
4. Analyse emerging technologies and interdisciplinary approaches within neuro-engineering, such as optogenetics, brain organoids, and advanced neural modelling, assessing their potential for both fundamental research and clinical translation.

CCT-76P-PCC-324-Nanomaterial Synthesis Lab

Semester	Code of the Course	Title of the Course/Paper				NHEQF Level	Credits
VI	CCT-76P-PCC-324	Nanomaterial Synthesis lab				6	02
Level of Course	Type of the Course	Credit Distribution			Offered to NC Student	Course Delivery Method	
		Theory	Practical	Total			
Advanced	PCC		02		No	PRACTICAL	
Objectives of the Course:		• To advance students' understanding of nanoparticle synthesis by incorporating new routes and structured nanomaterials. • To introduce simple thin film formation techniques and assess optical/magnetic properties. • To explore safe and scalable green synthesis methods. • To build a foundation for real-world applications through application-driven lab sessions.					

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Practical	CCT-76P-PCC-324– Nanomaterial Synthesis lab	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for **Nanomaterial Synthesis lab** should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-76P-PCC-324-Nanomaterial Synthesis Lab

LIST OF EXPERIMENTS:

1	Synthesis of Gold Nanoparticles Using Turkevich Method
2	Synthesis of Iron Oxide Nanoparticles via Co-precipitation
3	Green Synthesis of Silver Nanoparticles Using Aloe Vera/Neem Extract
4	Sol-Gel Synthesis of ZnO or TiO_2 Nanoparticles
5	Simple Thin Film Deposition via Drop-Casting or Spin Coating
6	Hydrothermal Synthesis of ZnO Nanostructures (Pre-prepared if time is short)
7	UV-Vis Spectroscopy of Silver or Gold Nanoparticles
8	XRD Analysis of Synthesized Nanoparticles

References

- G. Cao – *Nanostructures and Nanomaterials*, Imperial College Press
- C.N.R. Rao – *The Chemistry of Nanomaterials*, Wiley-VCH
- T. Pradeep – *A Textbook of Nanoscience and Nanotechnology*, McGraw Hill
- Additional research articles, handouts, and lab guides

Course Outcomes (COs):

1. Apply chemical and green synthesis methods to develop nanomaterials.
2. Demonstrate structured synthesis techniques like sol-gel and hydrothermal.
3. Perform basic thin-film formation methods on substrates.
4. Analyze optical properties using UV-Vis spectroscopy.
5. Evaluate crystal structure through XRD and understand basic diffraction principles.
6. Identify practical applications of synthesized nanomaterials.

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CCT-76P-PCC-325 Bioinformatics Lab

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
VI	CCT-76P-PCC-325	Bioinformatics Lab			7	2
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Advanced	PCC	-	2	2	Practical	
Objectives of the Course:		1. To introduce students to key bioinformatics databases and tools for sequence retrieval. 2. To develop basic skills in performing sequence similarity searches and alignments. 3. To familiarize students with biological file formats such as FASTA and GenBank. 4. To train students in protein structure visualization and motif/domain analysis. 5. To enable understanding of phylogenetic analysis and use of genome browsers for gene exploration.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Practical	CCT-76P-PCC-325– Bioinformatics Lab	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for **Bioinformatics Lab** should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-76P-PCC-325 Bioinformatics Lab

1. Explore and retrieve DNA and protein sequences using NCBI databases.
2. Perform sequence similarity search using BLAST (BLASTn and BLASTp).
3. Understand and identify FASTA format; retrieve and save sequences in FASTA.
4. Carry out pairwise sequence alignment using EMBOSS Needle or ClustalW.
5. Perform Multiple Sequence Alignment using Clustal Omega and visualize conserved regions.
6. Use RasMol or PyMOL to visualize 3D structure of proteins from PDB.
7. Identify conserved domains or motifs in protein sequences using ExPASy or Pfam.
8. Generate a phylogenetic tree using MEGA software or online tools (iTOL).
9. Browse and retrieve protein data from UniProt or PDB.
10. Introduction to ENSEMBL or UCSC genome browser for gene information.

Course Learning Outcomes:

1. Retrieve and interpret DNA and protein sequences using biological databases.
2. Perform and analyze sequence alignments using BLAST and Clustal tools.
3. Work with sequence file formats like FASTA and understand their applications.
4. Visualize protein structures and identify conserved motifs or domains.
5. Construct phylogenetic trees and explore genomic data using genome browsers.

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CCT-76P-PCC-326- MATLAB/SCILAB Programming Lab

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
VI	CCT-76P-PCC-326	MATLAB/SCILAB Programming Lab			7	2
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Advanced	PCC	-	2	2	Lectures	
Objectives of the Course:		Main objective of this practical paper is to understand the core features of MATLAB as a tool for numerical analysis and problem-solving.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Practical	CCT-76P-PCC-326– MATLAB/SCILAB Programming Lab	1 Hrs-CA 4 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The Practical examination Scheme for **MATLAB/SCILAB Programming Lab** should be as follows –

- Two Practical Exercises of 15 Marks each– 30 Marks
- Viva-Voce – 5 Marks
- Record – 5 Marks

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Detailed Syllabus

CCT-76P-PCC-326- MATLAB/SCILAB Programming Lab

List of Practical Problems:

1. Familiarity with MATLAB Environment
2. Arithmetic Operators and Arithmetic Expressions
3. Basic Matrix operations
4. Flow Control Statements – Various series- Sin, Cos, Fibonacci etc.
5. Array and Linear Operations
6. Math Functions
7. Basic Plots and Graphs
8. Basic Image Processing Operations

Course Learning Outcomes:

At the end of the course, students will understand following:

- Introduction to MATLAB Environment
- Basic MATLAB Programming Concepts
- Matrix and Array Operations
- Data Visualization and Plotting
- Working with Functions

CCT-76F-MC-302-Indian Knowledge System

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
VI	CCT-76F-MC-302	Indian Knowledge System			7	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	MC	02	-	02	Lectures (Thirty)	
Objectives of the Course:		Course Objectives • Introduce the concept, scope, and relevance of the Indian Knowledge System. • Familiarize students with classical texts, philosophies, and scientific traditions of India. • Encourage appreciation of holistic and sustainable approaches in Indian traditions. • Relate IKS concepts to modern-day applications.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (EoSE)	Minimum Marks (EoSE)
Theory	CCT-76F-MC-302-Indian Knowledge System	1 Hrs-CA 3 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 08 Marks
Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.
PART-B: 32 Marks
Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-76F-MC-302-Indian Knowledge System

Unit-I

Introduction to IKS

- Definition, concept, and scope of IKS.
- Historical evolution: from Vedic times to pre-modern period.
- Features of traditional education: *Gurukul, Pathashala*, Universities like *Nalanda, Takshashila.*
- Influence of colonial education policy (Macaulay's Minute).

(8 Hours)

Unit-II

Ancient Texts and Wisdom Traditions

- Vedas & Upanishads: Key concepts (*ṛta, ṛna, puruṣārtha, mokṣa*).
- Bhagavad *Gītā: Jñānayoga, Karmayoga, Bhaktiyoga*; concept of *sthitaprajña.*
- Epics (*Ramayana, Mahabharata*) as repositories of ethical and social knowledge.

(7 Hours)

Unit-III

Philosophical & Scientific Contributions

- Indian Philosophical Schools: Orthodox (*Nyāya*philosophy, Principles of *Vaiśeṣika, Sāṅkhya* approach of philosophy, Doctrine of *Pūrva-MīmāṃsāDarśana*, Thesis of *Vedānta* and synopsis of *Advaita*) & Heterodox (*Buddhism, Jainism, Charvaka*).
- Ancient Science & Technology: Mathematics (*Aryabhata*), Medicine (*Charaka*&*Sushruta*), Metallurgy, Architecture.
- Knowledge preservation through oral traditions, manuscripts.

(8 Hours)

Unit-IV

Holistic Living: Yoga, Ayurveda, and Environment

- Basics of *Yoga* and its eight limbs.
- Introduction to Ayurveda: principles, *doshas*, preventive healthcare.
- Environmental ethics in Indian tradition: concept of harmony with nature, examples from tribal communities.

(7 Hours)

Suggested Books and Reference:

Text books:

1. Textbook on The Knowledge System of *Bhārata* by Bhag Chand Chauhan,

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2. History of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata (2014).

Reference Books

1. *Bhagavad Gītā: Jñānayoga, Karmayoga, Bhaktiyog*a; concept of *sthitaprajña.*
2. D.N. Bose, S.N. Sen and B. V. Subbarayappa. (2009). A Concise History of Science in India, Indian National Science Academy, New Delhi.
3. Epics *(Ramayana, Mahabharata*) as repositories of ethical and social knowledge.
4. Soni, Suresh. (2010). *India's Glorious Scientific Tradition.* Ocean Books Pvt. Ltd.
5. Kapoor, K. (2021). *Indian Knowledge System: Nature, Philosophy, Character in Indian Knowledge System*. vol. 1, Pub. Indian Institute of Advanced Studies, Shimla
6. Kulkarni, Raghunath Purushottam. (2000). *Char Shulbsutra, Rashtriya Ved Vidya Sansthan.*
7. M. Hiriyanna, M. (1994). *Outlines of Indian Philosophy*, Motilal Banarsidass, New Delhi.
8. Mahadevan, B., Bhat, V.R., Pavana. N. (2022). *Knowledge: Framework and Classification, in Introduction to Indian Knowledge System*. Pub. PHI Learning, New Delhi.
9. Mahadevan, B., Bhat, V.R., Pavana, N. (2022). *Philosophical Systems, in Introduction to Indian Knowledge System.* Pub. PHI Learning, New Delhi.
10. Mahadevan, B., Vinayak Rajat Bhat, and R.N. Nagendra Pavana. (2022). *Introduction to Indian Knowledge System: Concepts and Applications*. PHI Learning Private Limited, New Delhi.
11. Pandey, Om Prakash. (2019). *Sanskritic Vichar ki Aviram Bhartiya Yatra*. Uttar Pradesh Hindi Sansthan, Lucknow.
12. Samskrit Bharati (2006). *Pride of India- A Glimpse of India's Scientific Heritage* edited by Pradeep Kohle et al.
13. Sharma, Arvind. *The Concepts of Dharma in Indian Tradition*.
14. Zimmer, Heinrich. *Philosophies of India*.

Course Learning Outcomes:

Upon completion of this course, students will be equipped with the following:

- Explain the origins, scope, and distinctive features of the Indian Knowledge System.
- Summarize key ideas from major texts like the Vedas, Upanishads, and Bhagavad Gītā, and recognize main schools of Indian philosophy.
- Highlight notable contributions of ancient India in philosophy, science, medicine, and architecture.
- Apply concepts from Yoga, Ayurveda, and environmental ethics to contemporary issues in health, well-being, and sustainability.

HSMC Elective Courses

S. No.	Course Code	Course Name	Credit	Semester
8.	CCT-HSMC-E1	Management for Managers	2	Any Four From V To VIII
9.	CCT-HSMC-E2	Digital Marketing	2	
10.	CCT-HSMC-E2	Cyber Crime and Digital Empowerment	2	
11.	CCT-HSMC-E4	The Social Lens: An Exploration of Sociology	2	
12.	CCT-HSMC-E5	Understanding Indian Society: A Sociological Perspective	2	
13.	CCT-HSMC-E6	Introduction to Indian Culture	2	
14.	CCT-HSMC-E7	Introduction to Indian History	2	

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CCT-HSMC-E1-Management for Managers

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V/VI/VII/VIII	CCT-HSMC-E1	Management for Managers			7	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	HSMC Elective	02	-	02	Lectures (Thirty)	
Objectives of the Course:		The objective of this course is to develop an understanding of the processes of management related with the basic functions, and management challenges in the emerging perspective.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-HSMC-E1–The Social Lens: An Exploration of Sociology	1 Hrs-CA 1 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-HSMC-E1-Management for Managers

UNIT-I

Introduction: Concept, Nature, Process and Significance of Management; Managerial Roles (Mintzberg); An Overview of Functional areas of Management. Management Approaches- System approach , Contingency approach .

(7 Lectures)

UNIT-II

Planning: Concept and purpose, Planning Process, Management by Objectives (MBO), Decision Making.

(8 Lectures)

UNIT-III

Organisation: Concept and purpose of organisation , Types of organisation , Line, Line &Staff , Matrix, Virtual Organisation structures. Concept of Authority, Functional Authority, Delegation of Authority, Centralisation and Decentralisation of Authority.

(8 Lectures)

UNIT-IV

Directing & Coordination, Leadership : Concept, Traits, Styles. **Controlling:** Concept, process, Requirement for adequate control.

(7 Lectures)

Suggested Books and References:

1. Stoner, Freeman , Gilbert Jr. : Management (Pearson education)
2. Kootz,O'Donnell , Weighrich : Essentials of Management
3. Michael , J. Stahl : Management -Total Quality in a global environment (Blackwell Business)
4. Newman , Warren and Summer : The Process of Management , Concept, Behaviour&Practice .
5. Brech ,E.F.L. : Principles and Practice of Management
6. Drucker ,P.F. :Managements ,Tasks ,Responsibilities , Practices

Course Learning Outcomes:

On successful completion of this course the students will be able to:

1. Students will understand fundamental management concepts, including the roles of managers, functional areas, and various management approaches.
2. Students will be able to apply planning, organizational structures, leadership, and control processes to effectively manage organizational challenges.

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CCT-HSMC-E2-Digital Marketing

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V/VI/VII/VIII	CCT-HSMC-E2	Digital Marketing			7	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	HSMC Elective	02	-	02	Lectures (Thirty)	
Objectives of the Course:		1. Understand the fundamental concepts and principles of digital marketing. 2. Develop strategies for effective online branding and communication. 3. Explore various digital marketing channels and their applications. 4. Understand legal and ethical considerations in digital marketing.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-HSMC-E2–Digital Marketing	1 Hrs-CA 1 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5.

There will be one question from each unit with an internal choice. Each question will carry 8

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Detailed Syllabus

CCT-HSMC-E2-Digital Marketing

UNIT-I

Introduction to Digital Marketing: Overview of digital marketing, Importance and benefits of digital marketing, Key concepts and terminology and Digital marketing in the Indian education system.

(7 Lectures)

UNIT-II

Online Branding and Communication: Branding strategies in the digital age, Creating a brand identity, Crafting compelling content, Effective storytelling in digital marketing and Personal branding for professionals.

(9 Lectures)

UNIT-III

Digital Marketing Channels: Search engine optimization (SEO), Pay Per-Click (PPC) advertising, Email marketing, Social media marketing, Content marketing., Influencer marketing and Affiliate marketing.

(8 Lectures)

UNIT-IV

Legal and Ethical Considerations: Privacy and data protection, Intellectual property rights, Online advertising regulations and Ethical issues in digital marketing.

(6 Lectures)

Suggested Books and References:

1. Gupta, S. (2018), Driving Digital Strategy: A Guide to Reimagining Your Business. Harvard Business Review Press.
2. Priluck, R. (2016), Social Media and Mobile Marketing Strategy. Oxford University Press.
3. Dave Chaffey and Fiona Ellis-Chadwick "Digital Marketing: Strategy, Implementation and Practice".
4. Eric Enge, Stephan Spencer, Jessie Stricchiola, and Rand Fishkin, "The Art of SEO: Mastering Search Engine Optimization".
5. Melissa Barker, Donald I. Barker, Nicholas F. Bormann, and Debra Zahay, "Social Media Marketing: A Strategic Approach".
6. Avinash Kaushik, "Web Analytics 2.0: The Art of Online Accountability and Science of Customer Centricity".

Course Learning Outcomes:

On successful completion of this course the students will be able to:

1. Start their own start up in the field of digital marketing.
2. Know the various aspects of digital marketing.

CCT-HSMC-E3-Cyber Crime and Digital Empowerment

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V/VI/VII/VIII	CCT-HSMC-E3	Cyber Crime and Digital Empowerment			7	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	HSMC Elective	02	-	02	Lectures (Thirty)	
Objectives of the Course:		1. To introduce students to the concept of cyber crimes, including their types, methods, and impact on society. 2. To educate students on the importance of digital literacy and how it can empower individuals and communities to protect themselves against cyber threats. 3. To provide an overview of the legal and regulatory frameworks that govern cyber crimes and digital rights in India. 4. Understand the significance of security and privacy in the digital world. Evaluate ethical issues in the cyber world. 5. To equip students with practical knowledge on how to stay safe online and make informed decisions in the digital world.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-HSMC-E3–Cyber Crime and Digital Empowerment	1 Hrs-CA 1 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

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Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus
CCT-HSMC-E3-Cyber Crime and Digital Empowerment

Unit-I

Digital Empowerment and Literacy

- Digital Literacy: Understanding the role of digital literacy in modern society.
- Empowerment through Digital Tools: How digital skills can empower individuals and communities.
- Digital Divide: Addressing the challenges and barriers to digital empowerment, including socio-economic factors.
- Practical Exercises: Hands-on activities to improve digital literacy, including secure internet practices and recognizing phishing attempts.

Unit-II

Introduction to Cyber Crimes

- Definition and Scope: What are cyber crimes? Understanding the cybercrime landscape.
- Types of Cyber Crimes: Detailed overview of various cyber crimes such as hacking, phishing, identity theft, cyberbullying, and online financial fraud.
- Impact of Cyber Crimes: Analysing the impact on individuals, businesses, and society at large.

Unit-III

Legal Framework for Cyber Crimes

- Cyber Crimes under Information Technology Act, 2000.
- Cyber Crimes under Bharatiya Nyaya Sanhita, 2023
- Threats in the digital world: Data breach and Cyber Attacks
- Security Initiatives by the Govt of India

Unit-IV

Online Safety and Digital Rights

- Best Practices for Online Safety: Secure browsing, password management, and protection against malware.
- Data Privacy and Protection: Understanding the importance of data privacy and how to protect personal information online.
- Digital Rights and Responsibilities: Exploring the concept of digital rights, including the right to privacy, freedom of expression, and the right to information.
- Empowerment Strategies: Developing strategies for digital empowerment, including advocacy for digital rights and participation in the digital economy.

Suggested Books and Online Resources:

1. Sunit Belapure & Nina Godbole, Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives (Wiley India, 2011).
2. Rodney Jones and Christoph Hafner. "Understanding digital literacies: A practical Introduction". Routledge Books, 2ndedition, 2021.
3. Cyber Hygiene - https://i4c.mha.gov.in/social-media.aspx
4. Cyber Jaagrookta- https://i4c.mha.gov.in/cyber-jagrookta.aspx
5. Cyber Safety Handbook - https://www.mha.gov.in/document/downloads/cyber-safety-handbook
6. https://www.digitalindia.gov.in
7. Cyber Crime Portal - https://www.cybercrime.gov.in
8. Cyber Surakshit Bharat Programme - https://www.meity.gov.in/cyber-surakshit-bharat-programme
9. Indian Computer Emergency Response Team - https://www.cert-in.org.in/

Course Learning Outcomes:

By the end of this course, students will be able to:

1. Identify Cyber Crimes: Recognize and describe various types of cyber crimes, such as hacking, phishing, cyberbullying, and online fraud.
2. Understand Digital Empowerment: Understand the concept of digital empowerment and how digital literacy can help protect against cyber threats.
3. Apply Legal Knowledge: Apply knowledge of relevant laws, such as the Information Technology Act, 2000, to understand the legal recourse available for cyber crimes.
4. Implement Online Safety Practices: Implement best practices for online safety, including secure communication, data protection, and privacy management.

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CCT-HSMC-E4-The Social Lens: An Exploration of Sociology

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V/VI/VII/VIII	CCT-HSMC-E4	The Social Lens: An Exploration of Sociology			7	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	HSMC Elective	02	-	02	Lectures (Thirty)	
Objectives of the Course:		The objective of the course is to provide a foundational understanding of sociological concepts, enabling students to develop a sociological imagination. This will enhance their awareness of social inequality, foster an appreciation for cultural diversity, and help them connect sociological ideas to everyday life.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-HSMC-E4–The Social Lens: An Exploration of Sociology	1 Hrs-CA 1 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-HSMC-E4-The Social Lens: An Exploration of Sociology

Unit-I

Sociology: An Introduction to the Discipline

- Definition, Nature, Human versus Animal Society.
- Origin of the discipline as a Sociology
- Subject matter of Sociology
- Relationship of Sociology with other social sciences: Anthropology, Psychology, History, Political Science and Economics

(8 Hours)

Unit-II

Key Concepts in Sociology

- Society, Culture, Norms and Values
- Social Groups, Status and Role
- Social Control and Socialization

(7 Hours)

Unit-III

Institutions and its Practices

- Family, Marriage and Kinship
- Religion, Economy and Polity

(8 Hours)

Unit-IV

Connecting Sociology to Everyday Life

- Application of Sociological Concepts to understand current events and personal experiences
- Sociology and Social Policies
- Sociology and Development

(7 Hours)

Suggested Books and Reference:

1. Bottomore, T.B. (1972).'Sociology–A Guide to problems and Literature, Bombay: George Allen and Unwin.
2. Davis, Kingsley. (1981).'Human Society', New Delhi: Surjeet Publications.

3. Giddens, Anthony. (1989).'Sociology', Oxford University: Polity Press.
4. Harlambos, M. (1998).'Sociology–Themes and Perspectives', New Delhi: Oxford University Press.
5. Inkeles, Alex (1987).'What is Sociology?' New Delhi: Prentice Hall.
6. Jayaram, N. (1988).'Introductory Sociology', Madras: McMillan India.
7. Gisbert, Pascual. (2004). Fundamentals of Sociology. Oriental Longman
8. Smelser, Neil. (1993). Sociology. Prentice Hall India Ltd. New Delhi.
9. Harry, Johnson M. (1960). Sociology A Systematic Introduction. New York

Course Learning Outcomes: Upon completion of this course, students will be equipped with the following:

1. A fundamental understanding of sociology as a discipline.
2. The ability to apply sociological concepts and ideas to interpret current events, personal experiences, and social trends.
3. Critical thinking skills to question existing social norms and structures, while considering the broader implications of social issues.
4. An understanding of the relevance of sociology to social policies and development initiatives.
5. The ability to connect sociology to everyday life and recognize the relationship between individual experiences and larger social forces.

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CCT-HSMC-E5-Understanding Indian Society: A Sociological Perspective

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V/VI/VII/VIII	CCT-HSMC-E5	Understanding Indian Society: A Sociological Perspective			7	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	HSMC Elective	02	-	02	Lectures (Thirty)	
Objectives of the Course:		The main objective of this course is to equip the students with a comprehensive understanding of the evolution of Indian society. To analyze the different dimensions of social stratification that exists in Indian Society. To explore the key socio-cultural issues and its impact on the structure of the Indian society and to identify the major problems and challenges faced by Indian society today.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-HSMC-E5– Understanding Indian Society: A Sociological Perspective	1 Hrs-CA 1 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus

CCT-HSMC-E5-Understanding Indian Society: A Sociological Perspective

Unit-I

An Idea of India from Past to Present

- Colonial
- Nationalist Views
- Unity in diversity

(7 Hours)

Unit-II

Society and Stratification

- Caste and its dimensions
- Tribes in India: Concept, Features their culture
- Rural and Urban India

(8 Hours)

Unit-III

Socio-Cultural Issues

- Patriarchy, Casteism
- Communalism, Regionalism and Linguistic Composition of India and their Problems

(8 Hours)

Unit-IV

Problems and Challenges of Indian Society

- Farmer's unrest, Violence against women and children
- Problems of elderly, Poverty, Unemployment.

(7 Hours)

Suggested Books and Reference:

1. Kaviraj, S., 2010, The Imaginary Institution of India, Ranikhet: Permanent Black, Pp.85-126
2. Haimendorf, C. V. F., 1967, "The Position of Tribal Population in India", in Mason India and Ceylon: Unity and Diversity, New York: Oxford University Press, Chapter 9
3. Guha, R., 1982, Subaltern Studies, Volume I. Delhi: OUP, Pp.1-8

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4. Ghurye, G.S; 1992 “Features of the Caste System” in Dipankar Gupta(ed.), Social Stratification in India, New Delhi: OUP, pp.35-48
5. Karve, Iravati. 1994, „The Kinship map of India“, in Patricia Uberoi(ed.) Family, kinship and marriage in India. Delhi: Oxford University Press, pp.50-73.
6. Madan, T.N., 1997, Modern Myths and Locked Minds. Delhi: Oxford University Press, Chapter 8.
7. Dumont, L. 1997, Religion, Politics and History in India. Paris: Mouton, Chapter 5.
8. Ahuja Ram, (2007). Social Problems in India, Rawat Publications, Jaipur
9. Deb Sibnath, (2005), Contemporary Social Problems in India-Anmol Prakashan, New Delhi.
10. Jogan Shankar, (1992), Social Problems and Welfare in India, New Delhi, Ashish Publishing House. New Delhi
11. Madan G.R., Indian Social Problems, Vol. I & II, New Delhi, Allied Publishers. Memoria C.B., Social Disorganization and Social Problems in India, New Delhi, Kitab Mahal
12. Paul Houton B.& Gerald Leslie R., (1974), The Sociology of Social Problems, Pearson Education India,
13. Sharma Ram Nath, Indian Social Problems, Mumbai, Media Promoters and Publishers.
14. Tripathi R.N., (2011), Indian Social Problems, - Pinnacle Technology, New Delhi

Course Learning Outcomes:

Upon completion of this course, students will be able to:

1. Demonstrate a comprehensive understanding of colonial and nationalist perspectives on Indian society, as well as the concept of unity in diversity.
2. Critically assess the role of caste, tribal cultures, and the rural-urban divide in shaping the structure and dynamics of Indian society.
3. Gain a thorough understanding of various socio-cultural issues, such as patriarchy and casteism, and their impact on social cohesion and regional stability in India.
4. Identify potential solutions to ongoing societal challenges, including farmer unrest, gender-based violence, unemployment, and other issues, by drawing on sociological theories and empirical evidence.

CCT-HSMC-E6-Introduction to Indian Culture

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V/VI/VII/VIII	CCT-HSMC-E6	Introduction to Indian Culture			7	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	HSMC Elective	02	-	02	Lectures (Thirty)	
Objectives of the Course:		The course aims to explore the foundational principles of Indian culture as rooted in the Vedic and philosophical traditions. It seeks to develop an understanding ofthecultural synthesis that occurred duringtheimperial periods, particularlyas reflectedin the realms of art,literature, and ethics. Further,thecourseintends to analysethereligious, social, and cultural dynamics of medieval India, with special emphasis on the Bhakti and Sufi movements. Lastly, it examines the cultural transformations and reformist responses that emerged under colonial rule and in modern India.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-HSMC-E6–Introduction to Indian Culture	1 Hrs-CA 1 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus
CCT-HSMC-E6-Introduction to Indian Culture

Unit-I

FoundationsofIndianCulture–VedicandPhilosophicalTraditions

- Vedic and Later Vedic Society: Social institutions: Varna and Ashrama systems, religious practices: Rituals, sacrifices, priesthood, Political and philosophical thoughtin Vedic literature
- Emergence of New Philosophies: Jainism and Buddhism: origins, key teachings, and social impact, Role in promoting ethical values and non-violence

(8 Hours)

Unit-II
ImperialSynthesisandCulturalExpression

- EmperorAshokaandtheConceptofDhamma:Ashokaninscriptionsandmoral governance, Influence on administration, ethics, and art
- GuptaPeriodCulture:The"GoldenAge":achievementsinart,science,and literature, the Development of temple architecture and classical Sanskrit
- IndianEpicsasCulturalTexts:RamayanaandMahabharata:themesofdharma, heroism, kinship, Ethical and philosophical ideas in the Bhagavad Gita

(7 Hours)

Unit-III

CultureandReligioninMedievalIndia

- SocialandReligiousLifeintheMedievalPeriod:Casteandgenderdynamics, religious diversity and transformations
- ImpactofIslam:Culturalexchanges:language,architecture, art
- BhaktiandSufiMovements:Keyfiguresandteachings:Kabir,Mirabai,Tulsidas, Guru Nanak
- Sufimysticismandsyncreticcultural practices

(8 Hours)

Unit-IV

CulturalChangeinModernIndia

- SocietyunderColonialRule:Socialreformsandcasterestructuring,Christian missionary activities and moral challenges
- Impact of Western Education: Role in shapingmodern Indian consciousness, Growth of social and cultural reform movements.

(7 Hours)

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RecommendedReadings:

1. A.L.Basham,*TheWonderThatWasIndia*–ChaptersonVedicsociety,religion,and philosophy
2. R.C.Majumdar,*AncientIndia*–Earlysocialinstitutionsandreligiousdevelopments Hermann Jacobi, *Jainism: An Indian Religion of Salvation* – Origins and ethics
3. B.R.Ambedkar,*TheBuddhaandHisDhamma*–InterpretationofBuddhistthought Romila Thapar, *Ashoka and the Decline of the Mauryas*– Dhamma and moral governance
4. D.D.Kosambi,*CultureandCivilizationinAncientIndiainHistoricalOutline*–Gupta culture and economy
5. DevduttPattanaik,*Jaya:AnIllustratedRetellingoftheMahabharata*–Cultural perspective
6. SatishChandra,*MedievalIndia:FromSultanatetotheMughals*–Society,Islam,and religious changes
7. RichardEaton,*IndiainthePersianateAge*–Islamiccultural impact
8. David N. Lorenzen, *Bhakti Religion in North India* – Bhakti traditions and saints CarlErnst,*Sufism:AnIntroductiontotheMysticalTraditionofIslam* –IndianSufi practices
9. BipanChandra,*ModernIndia*–Socialreformandcolonialsociety
10. SumitSarkar,*ModernIndia1885–1947*–Educationandculturalawakening

Course Learning Outcomes

After completing this course, students will be able to explain the key features of Vedic society and early Indian philosophical systems, while also evaluating the cultural and moral contributions of Emperor Ashoka and the Gupta period. They will gain the ability to interpret major Indian epics such as the *Ramayana*, *Mahabharata*, and *Bhagavad Gita* as rich sources of cultural, ethical, and philosophical values. Additionally, students will be equipped to analyse the religious diversity and socio-cultural transformations of medieval India, with a particular focus on the Bhakti and Sufi movements. Finally, they will be able to assess the impact of colonial rule and Western education on Indian society, especially in relation to social and cultural reform movements.

CCT-HSMC-E7-Introduction to Indian History

Semester	Code of the Course	Title of the Course/Paper			NHEQF Level	Credits
V/VI/VII/VIII	CCT-HSMC-E7	Introduction to Indian History			7	02
Level of Course	Type of the Course	Credit Distribution			Course Delivery Method	
		Theory	Practical	Total		
Introductory	HSMC Elective	02	-	02	Lectures (Thirty)	
Objectives of the Course:		This course aims to introduce students to the foundational concepts, sources, and interpretive methods of Indian history from ancient to modern times. It seeks to familiarize learners with the nature and scope of historical inquiry, the significance of archaeological and literary sources, and the broad developments in political, social, and religious spheres across historical periods.				

Examination Scheme for EoSE-

Type	Paper code and Nomenclature	Duration of Examination	Maximum Marks (CA + EoSE)	Minimum Marks (CA + EoSE)
Theory	CCT-HSMC-E7–Introduction to Indian History	1 Hrs-CA 1 Hrs-EoSE	10 Marks-CA 40 Marks-EoSE	4 Marks-CA 16 Marks-EoSE

The question paper will consist of **two** parts **A&B**.

PART-A: 8 Marks

Part A will be compulsory, having 8 very short answer-type questions (with a limit of 20 words) of one mark each.

PART-B: 32 Marks

Part B of the question paper shall be divided into four units comprising question numbers 2-5. There will be one question from each unit with an internal choice. Each question will carry 8 marks.

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Detailed Syllabus
CCT-HSMC-E7-Introduction to Indian History

Unit-I

UnderstandingHistoryandItsSources

- Meaning,nature,and scope
- Ideasofcontinuity,change,anddiversity
- *ArchaeologicalSources*:Monuments,inscriptions,coins,tools,pottery
- *LiterarySources*:Vedictexts,epics,Buddhist&Jainliterature, Puranas
- *ForeignAccounts*:ContributionsfromGreek(Megasthenes),Chinese(Fa-Hien),Arab (Al-Biruni) travellers
- *Modern Sources*: Official records, administrative reports, newspapers, autobiographies and biographies

(8Hours)

Unit-II

AncientIndianCivilizationsandCulturalDevelopments

- IndusValleyCivilization:Urbanculture,trade,decline
- VedicAge andFormationofJanapadas
- ReligiousMovements:Emergenceandphilosophyof Buddhismand Jainism
- MauryanEmpire:AdministrationunderChandraguptaandAshoka
- GuptaPeriod**:**Politicalstability,science,arts,andliterature

(7 Hours)

Unit-III

MedievalIndia:PoliticalandReligiousDynamics

- DelhiSultanate:Keydynastiesand theiradministrativesystems
- BhaktiandSufiTraditions:Social,devotional,andreformistmovements
- MughalEmpire:PoliticaldevelopmentsfromBaburtoAurangzeb
- Regional Powers: Role ofthe Marathas, Rajputs, and others in shapingIndian polity and society

(8Hours)

Unit-IV

ModernIndiaandtheFreedomStruggle

- EuropeanArrival:Portuguese,Dutch,French,and Britishexpansion
- ColonialRule:Policiesofexploitation,economicdrain,and resistance1857Revolt:Nature, causes,consequences
- Indian National Movement: Early Phase: Formation of Indian National Congress, GandhianEra:Non-Cooperation,CivilDisobedience,QuitIndiaMovements]Other Contributions: Role of revolutionaries, women, and social reformers, Partition and Independence (1947)

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(7 Hours)

RecommendedReadings:

1. *R.S.Sharma–Ancient India*
2. *SatishChandra –MedievalIndia*
3. *BipanChandra–Modern India*
4. *RomilaThapar – Early India*
5. *SumitSarkar –Modern India (1885–1947)*

Course Learning Outcomes

By the end of the course, students will be able to critically analyze the evolution of Indian society and polity—from the Indus Valley and Vedic eras to the Delhi Sultanate, Mughal Empire, and colonial rule—culminating in the Indian freedom struggle and independence. They will gain the ability to engage with key historical events, movements, and figures using evidence-based historical reasoning.