



# **GITAM**

(DEEMED TO BE UNIVERSITY)

(Estd. u/s 3 of the UGC Act, 1956)

**VISAKHAPATNAM \* HYDERABAD \* BENGALURU**

**Accredited by NAAC with 'A+' Grade**

## **REGULATIONS AND SYLLABUS**

**of**

**B.Tech Computer Science and Engineering with Specialization in**

**Artificial Intelligence and Machine Learning(AI&ML)**

**Data Science(DS)**

**Internet of Things(IoT)**

**Cyber Security(CS)**

**(w.e.f 2019-20 admitted batch)**

**A University Committed to Excellence**

**B.Tech Computer Science and Engineering with Specialization in  
Artificial Intelligence and Machine Learning(AI&ML)**

**Data Science(DS)**

**Internet of Things(IoT)**

**Cyber Security(CS)**

**REGULATIONS**

**(w.e.f. 2019-20 admitted batches)**

**1. ADMISSION**

1.1 Admission into B. Tech. in Computer Science and Engineering program with specialization in Artificial Intelligence and Machine Learning(AI&ML), Data Science(DS), Internet of Things(IoT), Cyber Security(CS) of GITAM (Deemed to be University) is governed by GITAM admission regulations.

**2. ELIGIBILITY CRITERIA**

2.1 A first class in 10+2 or equivalent examination approved by GITAM (Deemed to be University) with subjects Physics, Chemistry and Mathematics.

2.2 Admission into B.Tech. will be based on an All India Entrance Test (GITAM Admission Test - GAT) conducted by GITAM/Specified rank holders of JEE mains/EAMCET(AP & TS) are considered. For Bengaluru CET and COMEDK instead of EAMCET (AP & TS) are considered. The rules of reservation of statutory bodies, wherever applicable, will be followed.

**3. CHOICE BASED CREDIT SYSTEM**

3.1 Choice Based Credit System (CBCS) was introduced with effect from the academic year of 2015-16 admitted batch and revised in 2019-20 academic year, based on guidelines of the statutory bodies in order to promote:

- Activity based learning
- Student centered learning
- Cafeteria approach
- Learning at their own pace
- Interdisciplinary learning

3.2 Course Objectives, Learning Outcomes and Course Outcomes are specified, focusing on what a student should be able to do at the end of the course and program.

#### 4. STRUCTURE OF THE PROGRAM

4.1 The Program consists of courses based on humanities and social sciences, basic sciences, basic engineering, program core, program electives, open electives, interdisciplinary electives, industry internship, laboratory, mandatory courses and project work.

S. No.	Broad Course Classification	Course Group/ Category	Course Description
1	Foundation Courses	Basic Sciences	Mathematics, physics, chemistry and life sciences.
		Engineering Sciences	Fundamental engineering Courses
		Humanities and Social Sciences	Related to English, humanities, social sciences and management
2	Core Courses	Program Core	Branch specific and mandatory core courses
3	Elective Courses	Program Electives	Supportive to the discipline with expanded scope in a chosen track of specialization or cross track courses
		Interdisciplinary Electives	Interdisciplinary exposure to nurture the interest of a student in other department courses
		Open Electives	Common to all disciplines that nurtures general interest of a student
4	Core Activities	Project Work	University or industry
		Internship	Training in industry or research organization
5	Mandatory Courses		Non-credit mandatory courses on Induction Program, Environmental Sciences, Indian Constitution, Essence of Indian Traditional Knowledge.

4.2 Each course is assigned a certain number of credits depending upon the number of contact hours (lectures/tutorials/practical) per week.

4.3 In general, credits are assigned to the courses based on the following contact hours per week.

- One credit for each Lecture/Tutorial hour per week.
- One credit for two hours of Practical's per week.

## **5. MEDIUM OF INSTRUCTION**

The medium of instruction (including examinations and project reports) shall be English.

## **6. REGISTRATION**

Every student has to register for the courses in each semester at the time specified in the academic calendar.

## **7. ATTENDANCE REQUIREMENTS**

- 7.1 A student whose attendance is less than 85% in all the courses put together in any semester will not be permitted to attend the end semester examination and will not be allowed to register for subsequent semester of study. He/she has to repeat the same semester along with his/her juniors.
- 7.2 However, the Vice-Chancellor on the recommendation of the Principal / Director of the Institute/School may condone the shortage of attendance of the students whose attendance is between 75% and 84% on medical grounds and on payment of prescribed fee.

## **8. EVALUATION**

- 8.1 Assessment of the performance of a student in theory courses shall be based on two components: Continuous Evaluation (40 marks) and Semester-end Examination (60 marks).
- 8.2 A candidate has to secure a minimum of 40% in any theory course in the two components (ref 8.1) put together to be declared to have passed the course, subject to the condition that the student must have secured a minimum of 24 marks out of 60 marks (i.e. 40%) in the theory component at the semester-end examination.
- 8.3 Practical courses are assessed under Continuous Evaluation for a maximum of 100 marks, and a student has to obtain a minimum of 40% to secure pass grade.
- 8.4 For courses having both theory and practical components, 70% of the weightage will be given for theory component and 30% weightage for practical component. The student has to acquire 40% in the semester end theory examination. However, student must have secured overall 40% (Theory + Practical) to secure pass grade.
- 8.5 Project Work/ Industrial internship courses are assessed under continuous evaluation for a maximum of 100 marks, and a student has to obtain a minimum of 40% to secure pass grade.
- 8.6 Mandatory courses are assessed for PASS or FAIL only. No credits will be assigned to these courses. If a student secures more than 40 out of 100 marks, he / she will be declared PASS, else FAIL. PASS grade is necessary to be eligible to get the degree.

8.7 Mandatory courses Induction Program/Environmental Sciences/Indian Constitution/Essence of Indian Traditional Knowledge are assessed for satisfactory or not satisfactory only. No grade will be assigned. A student has to undergo two hours training per week in any one of the above in both I and II semesters and should obtain satisfactory grade to be eligible to get degree.

The details of Assessment Procedure are furnished in Table 1.

Table 1: Assessment Procedure

S.No	Component of Assessment	Types of Assessment	Marks Allotted	Scheme of Evaluation
1	Theory courses	Continuous Evaluation	40	(i) Thirty (30) marks for mid semester examinations. Three mid examinations shall be conducted for 15 marks each; performance in best two shall be taken into consideration. ii) Ten (10) marks for Quizzes, Assignments and Presentations.
		Semester End Examinations	60	Sixty (60) marks for semester-end Examinations.
		Total	100	
2	Practical courses	Continuous Evaluation	100	(i) Fifty (50) marks for regularity and performance, records and oral presentations in the laboratory. Weightage for each component shall be announced at the beginning of the semester. ii) Ten (10) marks for case studies. iii) Forty (40) marks for two tests of 20 marks each (one at the mid-term and the other towards the end of the semester) conducted by the concerned lab teacher.

3	Theory and Practical combined courses	<p>(a) Theory component: continuous evaluation and semester end examination.</p> <p>(b) Practical component: continuous evaluation</p> <p>Total</p>	<p>100</p> <p>100</p> <p>200</p>	<p>70% of the weightage will be given for theory component. Evaluation for theory component shall be same as S. No 1 as above.</p> <p>30% weightage for practical components. Evaluation for practical component shall be same as S. No 2 as above</p>
4	Project work (VII & VIII Semesters)	Continuous Evaluation	100	<p>i) Forty (40) marks for periodic evaluation on originality, innovation, sincerity and progress of the work assessed by the project supervisor.</p> <p>ii) Thirty (30) marks for mid-term evaluation by a panel of examiners.</p> <p>iii) Thirty (30) marks for final report, presentation and Viva-voce by a panel of examiners.</p>
5	Industrial Internship (VI&VII Semester)	Continuous Evaluation	100	<p>i) Thirty (30) marks for performance assessed by the Supervisor of the host Industry/ Organization. Submission of Project Completion Certificate from host organization is mandatory.</p> <p>ii) Forty (40) marks for Report and Seminar presentation on the training, assessed by the Teacher Coordinator.</p>

				iii) Thirty (30) marks for presentation on the training, before a panel of examiners.
6	Mandatory Courses	Continuous Evaluation	100	Sixty (60) marks for midterm semester examinations. Three midterm examinations shall be conducted for 30 marks each; performance in best two shall be taken into consideration.  Forty (40) marks for Quizzes, Assignments and Presentations.

## 9. RETOTALING & REVALUATION

- 9.1 Retotaling / revaluation of any theory answer script of the semester-end examination is permitted on request by a student by paying the prescribed fee within one week after the announcement of the results.
- 9.2 Revaluation of the theory answer scripts of the semester-end examination is permitted on request by student by paying the prescribed fee within one week after the announcement of the results.
- 9.3 A student who has secured 'F' grade in a theory course shall have to reappear at the subsequent examination held in that course. A student who has secured 'F' grade can improve continuous evaluation marks upto a maximum of 50% by attending special instruction classes held during summer.
- 9.4 A student who has secured 'F' grade in a practical course shall have to attend special instruction classes held during summer.
- 9.5 A candidate who has secured 'F' grade in a combined (theory and practical) course shall have to reappear for theory component at the subsequent examinations held in that course. A student who has secured 'F' grade can improve continuous evaluation marks upto a maximum of 50% by attending special instruction classes held during summer.
- 9.6 A student who has secured 'F' Grade in project work / Industrial Training shall be permitted to submit the report only after satisfactory completion of the work and viva-voce examination.

## 10. PROVISION FOR VERIFICATION OF ANSWER BOOK AND CHALLENGEEVALUATION

- 10.1 If a student is not satisfied with his/her grade after revaluation, the student can apply for verification of answer book on payment of prescribed fee for each course within one week after announcement of revaluation results.

10.2 After verification, if a student is not satisfied with revaluation marks/grade, he/she can apply for challenge valuation within one week after announcement of answer book verification result or two weeks after the announcement of revaluation results, which will be valued by the two examiners i.e., one Internal and one External examiner on payment of prescribed fee. The challenge valuation fee will be refunded, if the student is successful in the appeal by securing a better grade.

## **11. SUPPLEMENTARY AND SPECIAL EXAMINATIONS**

11.1 The odd (I, III, V, VII) semester supplementary examinations will be conducted after conducting regular even semester examinations during April/May.

11.2 The even (II, IV, VI, VIII) semester supplementary examinations will be conducted after conducting regular odd semester examinations during October/November.

11.3 A student who has completed period of study and still has “F” grade in final semester courses is eligible to appear for special examination.

## **12. PROMOTION TO THE NEXT YEAR OF STUDY**

12.1 A student shall be promoted to the next academic year only if he/she passes 60% of the credits till that academic year.

12.2 Whenever there is a change in syllabus or curriculum he/she has to continue the course with new syllabus and regulations after detention as per the equivalency established by the BoS to continue his/her further studies.

## **13. MASSIVE OPEN ONLINE COURSES**

Greater flexibility to choose variety of courses is provided through Massive Open Online Courses (**MOOCs**) during the period of study. Students without any backlog courses upto fourth semester are permitted to register for MOOCs from fifth semester onwards up to a maximum of 15 credits from program elective/ interdisciplinary elective/ open elective courses. However the Departmental Committee (DC) of the respective campuses has to approve the courses under MOOCs. The grade equivalency for these courses will be decided by the respective Board of Studies (BoS).

## **14. ELIGIBILITY FOR AWARD OF THE B. Tech. DEGREE**

14.1 The curriculum of the eight semesters B.Tech. program is designed to have a total of 162 credits for the award of B.Tech. degree.

14.2 Duration of the program: A student is ordinarily expected to complete the B. Tech program in eight semesters of four years. However, a student may complete the program in not more than eight years including study period.

14.3 However, the above regulation may be relaxed by the Vice- Chancellor in individual cases for cogent and sufficient reasons.

14.4 A student shall be eligible for award of the B.Tech. Degree if he / she fulfils the following conditions:

- i) Registered and successfully completed all the courses and project as per the curriculum.
- ii) Successfully acquired the minimum required credits as specified in the curriculum in the branch of his/her study within the stipulated time.
- iii) Has no dues to the Institute, Hostels, Libraries, NCC/NSS etc., and no disciplinary action is pending.

## 15. B. Tech (HONORS)

A student who secured 8.0 CGPA or above up to IV semester is eligible to register for B. Tech (Honors) degree. The student has to complete additional 20 credits (six theory courses + seminar) as approved by the respective DC to secure B. Tech (Honors). The courses will be approved by DC of respective campuses.

## 16 GRADING SYSTEM

16.1 Based on the student performance during a given semester, a final letter grade will be awarded at the end of the semester in each course. The letter grades and the corresponding grade points are as given in Table 2.

Table 2: Grades and Grade Points

S.No.	Grade	Grade Points	Absolute Marks
1	O (Outstanding)	10	90 and above
2	A+ (Excellent)	9	80 to 89
3	A (Very Good)	8	70 to 79
4	B+ (Good)	7	60 to 69
5	B (Above Average)	6	50 to 59
6	C (Average)	5	45 to 49
7	P (Pass)	4	40 to 44
8	F (Fail)	0	Less than 40
9	Ab. (Absent)	0	-

16.2 A student who earns a minimum of 4 grade points (P grade) in a course is declared to have successfully completed the course, subject to securing CGPA of 5.0 at the end of the program to declare pass in the B. Tech program.

## 17. GRADE POINT AVERAGE

17.1 A Grade Point Average (GPA) for a semester is calculated as follows:

$$\text{GPA} = \frac{\Sigma [ C * G ]}{\Sigma C}$$

where,

C = number of credits for the course.

G = grade points obtained by the student in the course.

17.2 The Cumulative Grade Point Average (CGPA), is calculated using the above formula considering the grades obtained in all the courses, in all the semesters up to that particular semester, in all the semesters upto that particular semester.

17.3 CGPA required for classification of class after the successful completion of the program is shown in Table 3.

Table 3: CGPA required for award of Class

Class	CGPA Required
First Class with Distinction	$\geq 8.0^*$
First Class	$\geq 6.5$
Second Class	$\geq 5.5$
Pass Class	$\geq 5.0$

\* In addition to the required CGPA of 8.0 or more, the student must have necessarily passed all the courses in the first attempt.

## 18. BETTERMENT OF GRADES

18.1 A student who has secured only a pass or second class and desires to improve his/her class can appear for betterment examinations for only upto eight theory courses of his/her choice, conducted in summer vacation along with the special examinations.

18.2 Betterment of Grades is permitted 'only once', immediately after completion of the program of study.

## 19. DISCRETIONARY POWER

Notwithstanding anything contained in the above sections, the Vice-Chancellor may review all exceptional cases, and give his decision, which will be final and binding.

**Department of Computer Science and Engineering(CSE)**  
**Common Structure for CSE Specializations (AI&ML, DS, IoT, CS )**  
(Effective from the academic year 2019-20 admitted batch)

**Semester I**

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA101	Engineering Mathematics I (Calculus and Algebra)	BS	3	0	0	0	3	Common to all except BT
2.	GEL131	Communicative English	HS	2	0	2	0	3	Common to all
3.	19EPH131/ 19ECY131	Engineering Physics / Engineering Chemistry	BS/BS	3	0	3	0	4.5	Common to all
4.	19EID133	Problem Solving and Programming with Python	ES	3	1	3	0	5.5	Common to all
5.	19EME121/ 19EME131	Workshop / Engineering Graphics	ES/ES	0/1	0	3	0	1.5/2.5	Common to all
6.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	NCC/NSS/NSO/YOGA	MC	0	0	2	0	0	Common to all
7.	19VDC111	Venture Discovery	ES	0	0	4	0	2	Common to all
<b>Total</b>								<b>19.5/20.5</b>	

**Semester II**

S. No.	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA104	Engineering Mathematics II (Probability and Statistics)	BS	3	0	0	0	3	Common with CSE
2.	19EID134/ 19EID234	AI Tools/ Life Sciences for Engineers	ES/BS	2	0	2	0	3	Common to all
3.	19ECY131/ 19EPH131	Engineering Chemistry / Engineering Physics	BS	3	0	3	0	4.5	Common to CSE/ECE/EEE
4.	19EEE131	Basic Electrical and Electronics Engineering	ES	3	1	3	0	5.5	Common to all
5.	19EME131/ 19EME121	Engineering Graphics / Workshop	ES	1/0	0	3	0	2.5/ 1.5	Common to all
6.	19ECS237	Data Structures with Python	PC	2	0	3	0	3.5	Common with CSE
7.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	NCC/NSS/NSO/YOGA	MC	0	0	2	0	0	Common to all
8.	19EHS122	Comprehensive Skill Development /Activity Based Learning I	HS	0	0	0	6	1	Common to all
<b>Total</b>							<b>23/22</b>		

### Semester III

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA205	Engineering Mathematics-III (Discrete Mathematical Structures)	BS	3	0	0	0	3	Common with CSE
2.	19EID234/ 19EID134	Life Sciences for Engineers/AI tools	BS/ES	2	0	2	0	3	Common to all
3.	19EID132	Design Thinking and Product Innovation	ES	2	0	2	0	3	Common to all
4.	19ECS201	Fundamentals of Digital Logic Circuits	PC	3	0	0	0	3	Common to all
5.	19ECS231	Object Oriented Programming Through Java	PC	2	0	3	0	3.5	Common with CSE
6.	19ECS203	Data Communications	PC	2	0	0	0	2	Common with CSE
7.	19ECS221	Computer Engineering Workshop	ES	0	0	4	0	2	Common with CSE
8.	19EMC281/ 19EMC282	Constitution of India/ Environmental Sciences	MC	2	0	0	0	0	Common to all
9.	19EHS221	Comprehensive Skill Development /Activity Based Learning II	HS	0	0	0	6	1	Common to all
<b>Total</b>							<b>20.5</b>		

### Semester IV

S.No.	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1	19EMA210	Engineering Mathematics-IV (Differential equations)	BS	3	0	0	0	3	AI&ML
	19EMA206	Engineering Mathematics-IV (Number Theory and its Applications)	BS	3	0	0	0	3	CS
	19EMA212/ 19EMA214	Engineering Mathematics IV (Descriptive Statistics/ Applied Statistics for Data Science)	BS	3	0	0	0	3	DS & IoT
2	19EID232	Internet of Things	ES	2	0	2	0	3	Common to all
3	19ECS202	Computer Organization and Architecture	PC	3	0	0	0	3	Common with CSE
4.	19ECS204	Operating Systems	PC	3	0	0	0	3	Common with CSE
5.	19ECS232	Computer Networks	PC	3	0	2	0	4	Common with CSE
6.	19EAI232	Introduction to Artificial Intelligence and its Applications	PC	3	0	2	0	4	Common to AI&ML/ CS/ DS
	19EIO232	Sensor Technology and Instrumentation	PC	3	0	2	0	4	IoT
7.	19EMC282/ 19EMC281	Environmental Sciences / Constitution of India	MC	3	0	0	0	0	Common to all
8.	19ECS292	Comprehensive Skill Development /Activity Based Learning III	PW	0	0	0	6	1	Common to all
<b>Total</b>								<b>21</b>	

**Semester V**

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19ECS333	Database Management Systems	PC	3	0	2	0	4	Common with CSE
2.	19EAI331	Artificial Neural Networks	PC	2	0	2	0	3	AI&ML & DS
	19ECS305	Cryptography and Network Security	PC	3	0	0	0	3	CSE & CS
	19EIO331	Interfacing through Microprocessors & Microcontrollers	PC	2	0	2	0	3	IoT
3.	19ECS234	Design and Analysis of Algorithms	PC	3	0	2	0	4	Common with CSE
4.	19ECS3XX/ 19EAI3XX/ 19ECF3XX/ 19EDS3XX/ 19EIO3XX	Program Elective I	PE	2	0	2	0	3	Program Specific
5.	19EOE3XX	Open Elective I	OE	3	0	0	0	3	Common to all
6.	19EID3XX	Interdisciplinary Elective I	ID	2	0	2	0	3	
7.	19ECS391	Comprehensive Skill Development /Activity Based Learning IV	PW	0	0	0	6	1	Common to all
<b>Total</b>							<b>21</b>		

**Semester VI**

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1	19EAI332	Automata Theory and Compiler Design	PC	4	0	3	0	5.5	Common for AI&ML/ CS/ DS/ IoT
2	19EAI334	OOSE based Application Development	PC	3	0	3	0	4.5	Common for AI&ML/ CS/ DS/ IoT
3	19EAI336	Machine Learning and its Applications	PC	3	0	2	0	4	AI&ML
	19ECF332	Ethical Hacking	PC	3	0	2	0	4	CS
	19EDS332	Data Visualization And Exploration with R	PC	3	0	2	0	4	DS
	19EIO332	Wireless Sensor Networks	PC	3	0	2	0	4	IoT
4	19ECS3XX/ 19EAI3XX/ 19ECF3XX/ 19EDS3XX/ 19EIO3XX	Program Elective II	PE	2	0	2	0	3	Program Specific
5	19EOE3XX	Open Elective II	OE	2	0	2	0	3	Common to all
6	19EHS302	HS-I(Engineering Economics and Management)	HS	3	0	0	0	3	Common with CSE
7	19EMC382	Engineering Ethics	MC	3	0	0	0	0	Mandatory Course
8	19ECS392	Comprehensive Skill Development /Activity Based Learning V	PW	0	0	0	6	1	Common to all
<b>Total</b>								<b>24</b>	

**Semester VII**

<b>S. No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>A</b>	<b>C</b>	<b>Remarks</b>
1	19EAI431	Deep Learning	PC	3	0	2	0	4	Common to AI&ML/DS
	19ECF431	Digital Forensics	PC	3	0	2	0	4	CS
	19EIO431	Embedded Systems and its Applications	PC	3	0	2	0	4	IoT
2	19EAI433	Big Data Analytics	PC	2	0	2	0	4	Common to AI&ML/DS
	19ECF433	Mobile Application Security	PC	2	0	2	0	4	CS
	19EIO433	Cloud Based IoT	PC	2	0	2	0	4	IoT
3	19ECS4XX/ 19EAI4XX/ 19ECF4XX/ 19EDS4XX/ 19EIO4XX	Program Elective III	PE	2	0	2	0	3	Program Specific
4	19ECS4XX/ 19EAI4XX/ 19ECF4XX/ 19EDS4XX/ 19EIO4XX	Program Elective IV	PE	2	0	2	0	3	Program Specific
5	19EHS403	HS-II(Organizational Behavior)	HS	3	0	0	0	3	
6	19ECS497	Project Phase I	PW	0	0	2	0	1	Common with CSE
7	19ECS493	Internship	PW	0	0	0	0	1	Common with CSE
8	19ECS495	Comprehensive Skill Development /Activity Based Learning VI	PW	0	0	0	6	1	Common to all
<b>Total</b>								<b>20</b>	

### Semester VIII

S.No	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EID4XX	Interdisciplinary Elective II	ID	2	0	2	0	3	
2.	19ECS4XX/ 19EAI4XX/ 19ECF4XX/ 19EDS4XX/ 19EIO4XX	Program Elective V	PE	2	0	2	0	3	Program Specific
3.	19ECS492	Project Phase II	PW	0	0	12	0	6	Common with CSE
4.	GSS115	Gandhi for the 21 <sup>st</sup> Century	HS	0	0	0	0	1	Common to all
<b>Total</b>							<b>13</b>		

### Total Number of Credits distribution

Semester	I	II	III	IV	V	VI	VII	VIII	Total
Credits	19.5/ 20.5	23/22	20.5	21	21	24	20	13	162

**Category wise and Credits distribution**

Category	Code	Courses	Credits GITAM	Credits suggested by AICTE
<b>Humanities &amp; Social Sciences</b>	HS	Communicative English	<b>12</b>	<b>12</b>
		HS1 and HS2 (elective)		
		Gandhi for the 21 <sup>st</sup> Century		
		Comprehensive Skill Development/ Activity based Learning- I		
		Comprehensive Skill Development/ Activity based Learning- II		
<b>Basic Sciences</b>	BS	Engineering Physics	<b>24</b>	<b>25</b>
		Engineering Chemistry		
		Mathematics (4 Courses)		
		Life Sciences for Engineers		
<b>Engineering Sciences</b>	ES	Problem Solving and Programming with Python	<b>28</b>	<b>24</b>
		Basic Electrical and Electronics Engineering		
		AI Tools		
		Engineering Graphics		
		Workshop		
		Design Thinking and Product Innovation		
		Internet of Things		
		VDC		
Computer Engineering Workshop				
<b>Open Electives</b>	OE	OE1, OE2	<b>6</b>	<b>18</b>
<b>Interdisciplinary Electives</b>	ID	ID1, ID2	<b>6</b>	
<b>Program Electives</b>	PE	PE1 – PE5	<b>15</b>	
<b>Program Core</b>	PC	PC1 – PC16	<b>59</b>	<b>48</b>
<b>Project</b>	PW	Internship	<b>12</b>	<b>15</b>
		Project Phase I		
		Project Phase II		
		Comprehensive Skill Development/ Activity based Learning- III		
		Comprehensive Skill Development/ Activity based Learning- IV		
		Comprehensive Skill Development/ Activity based Learning- V		
		Comprehensive Skill Development/ Activity based Learning- VI		
<b>Mandatory</b>	MC	Environmental Science, Constitution of India, Engineering Ethics	-	-
<b>Total</b>			<b>162</b>	<b>160</b>

## Engineering Mathematics II

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EMA102	Engineering Mathematics II (ODE, PDE and Multivariable Calculus)	BS	3	0	0	3	Offered for ECE, EEE, ME and CE
2.	19EMA104	Engineering Mathematics II (Probability and Statistics)	BS	3	0	0	3	Common with CSE
3.	19EMA106	Mathematics for Biotechnology II	BS	3	0	0	3	Offered for BT

## Engineering Mathematics III

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EMA201	Engineering Mathematics III (Applications of PDE, Complex Variables and Transform Techniques)	BS	3	0	0	3	Offered for ME and CE
2.	19EMA203	Engineering Mathematics III (Complex Variables and Transform Techniques)	BS	3	0	0	3	Offered for ECE and EEE
3.	19EMA205	Engineering Mathematics III (Discrete Mathematical Structures)	BS	3	0	0	3	Common with CSE
4.	19EMA207	Mathematics for Biotechnology III	BS	3	0	0	3	Offered for BT

### Engineering Mathematics IV

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EMA202/ 19EMA104	Engineering Mathematics IV (Numerical Methods/ Probability and Statistics)	BS	3	0	0	3	Offered for CE/ME/EEE
2.	19EMA204	Engineering Mathematics IV (Probability Theory and Random Process)	BS	3	0	0	3	Offered for ECE
3.	19EMA206/ 19EMA202/ 19EMA210	Engineering Mathematics IV (Number Theory and Applications/ Numerical methods/ Differential equations)	BS	3	0	0	3	Offered for CS/ CSE / AI&ML
4.	19EMA208	Mathematics for Biotechnology IV	BS	3	0	0	3	Offered for BT
5.	19EMA212/ 19EMA214	Engineering Mathematics IV (Descriptive Statistics/Applied Statistics for Data Science)	BS	3	0	0	3	Offered for DS/IoT

### Engineering Physics

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19EPH131	Engineering Physics	BS	3	0	3	4.5	Offered for ECE/CSE/ AI&ML/ CS/ DS/ IoT/ EEE
2.	19EPH133	Applied Physics	BS	3	0	3	4.5	Offered for AE, CE and ME
3.	19EPH135	Physics for Biotechnology	BS	3	0	3	4.5	Offered for BT

### Engineering Chemistry

S.No	Course Code	Course Title	Category	L	T	P	C	Remarks
1.	19ECY131	Engineering Chemistry	BS	3	0	3	4.5	Offered for ECE/ CSE/ AI&ML/ CS/ DS/ IoT/ EEE
2.	19ECY133	Chemistry of materials	BS	3	0	3	4.5	Offered for AE, CE and ME
3.	19ECY135	Chemistry for Biotechnology	BS	3	0	3	4.5	Offered for BT

## OPEN ELECTIVES

### Open Elective I

S. No.	Course Code	Course Title	Category	L	T	P	C
1	19EOE301	Japanese for Beginners	OE	3	0	0	3
2	19EOE303	French for Beginners	OE	3	0	0	3
3	19EOE305	Biotechnology and Society	OE	3	0	0	3
4	19EOE307	Contemporary Relevance of Indian Epics	OE	3	0	0	3
5	19EOE309	Indian National Movement	OE	3	0	0	3
7	19EOE313	Personality Development	OE	3	0	0	3
8	19LOE301	Fundamentals of Cyber Law	OE	3	0	0	3
9	19MOE303	Introduction to International Business	OE	3	0	0	3
10	19EOE319	Introduction to Music	OE	3	0	0	3
11	19EOE321	Environment and Ecology	OE	3	0	0	3
12	19EOE323	Indian History	OE	3	0	0	3
13	19EOE327	Professional Communication	OE	3	0	0	3
14	19EOE224	Virtual Reality	OE	1	0	4	3

## Open Elective II

S.No.	Course Code	Course Title	Category	L	T	P	C
1	19EOE302	German for Beginners	OE	3	0	0	3
2	19EOE304	Chinese for Beginners	OE	3	0	0	3
3	19EOE306	Analytical Essay Writing	OE	3	0	0	3
4	19EOE308	Indian Economy	OE	3	0	0	3
5	19EOE310	Public Administration	OE	3	0	0	3
6	19EOE312	Environmental Management	OE	3	0	0	3
7	19EOE327	Professional Communication	OE	3	0	0	3
8	19MOE301	Basics of Finance	OE	3	0	0	3
9	19LOE301	Fundamentals of Cyber Law	OE	3	0	0	3
10	19EOE313	Personality Development	OE	3	0	0	3
11	19MOE305	Basics of Marketing	OE	3	0	0	3

## PROGRAM ELECTIVES

### Program Elective- I

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	AI&ML	19ECS343	Advanced Data Structures for Machine Learning	PE	2	0	2	3
2	Cyber Security	19ECF341/ 19ECS345 19ECF343	Operating System Security/ Advanced Computer Networks/ Mobile Application Security	PE	2	0	2	3
3	Data Science	19EDS341/ 19EDS343/ 19EDS345	Data Visualization and Exploration with R/ E-Commerce / Soft Computing	PE	2	0	2	3
4	IoT	19ECS362/ 19EIO341	Cloud Computing/ Software Defined Networks	PE	2	0	2	3

**Note:** The faculty has to design the activity for each Program Elective.

### Program Elective- II

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	AI&ML	19ECS342/ 19EDS345	Data Warehousing and Data Mining/ Soft Computing	PE	2	0	2	3
2	Cyber Security	19ECF341/ 19ECF343/ 19ECF345	Web Application Security/ Malware Analysis and Reverse Engineering/ Security for Cyber Physical Systems	PE	2	0	2	3
3	Data Science	19EDS342/ 19EDS344	Data Analytics with Tableau/ Operation Research	PE	2	0	2	3
4	IoT	19EIO342/ 19EIO344	IoT Architecture and protocols/ Energy Management for IoT devices	PE	2	0	2	3

**Note:** The faculty has to design the activity for each Program Elective.

**Program Elective- III**

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	AI&ML	19EAI441	Web Mining	PE	2	0	2	3
2	Cyber Security	19ECF441/ 19ECF443/ 19ECF445	Cloud Security/ IoT Security/ Android Security Internals	PE	2	0	2	3
3	Data Science	19ECS362/ 19EDS441/ 19ECS459	Cloud Computing/ Health Analytics/ Block Chain Technology	PE	2	0	2	3
4	IoT	19EIO441/ 19EIO443	IoT for Industries/ IoT Technologies and Applications	PE	2	0	2	3

**Note:** The faculty has to design the activity for each Program Elective.

**Program Elective- IV**

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	AI&ML	19ECS443/ 19EAI445	Natural Language Processing/ Digital Image Processing	PE	2	0	2	3
2	Cyber Security	19ECF447/ 19ECF449/ 19ECS459	Intrusion Detection and Prevention Systems/ Threat Intelligence/ Block Chain Technology	PE	2	0	2	3
3	Data Science	19ECS441/ 19ECS443	Information Retrieval Systems/ Natural Language Processing	PE	2	0	2	3
4	IoT	19ECS344/ 19EIO441 19EAI331	Machine Learning/ Edge Computing/ Artificial Neural Networks	PE	2	0	2	3

**Note:** The faculty has to design the activity for each Program Elective.

**Program Elective- V**

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	AI&ML	19EAI442/ 19EAI444	Computer Vision/ Quantum Computing for Computer Science	PE	2	0	2	3
2	Cyber Security	19ECS344/ 19EAI444/ 19ECF446/ 19ECF448	Machine Learning/ Quantum Computing for Computer Science / Cyber Law and IT Protection/ Fundamentals of IOS Security	PE	2	0	2	3
3	Data Science	19EDS442/ 19EAI444/ 19ECF444	Social Media Analytics/ Quantum Computing for Computer Science/ Financial Analytics	PE	2	0	2	3
4	IoT	19ECF443/ 19EIO444	IoT Security/ Communication and Network Technologies in IoT	PE	2	0	2	3

**Note:** The faculty has to design the activity for each Program Elective.

## INTERDISCIPLINARY ELECTIVES

### Interdisciplinary Elective I

S.No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Professional Courses	19EEC371	Fundamentals of Communication Systems	ID	2	0	2	3
2		19EIE371	Qualitative Techniques	ID	2	0	2	3
3		19EEI371	Sensors & Technology	ID	2	0	2	3
4	Basic Science Courses	19ECY371	Applications of Chemistry in Electronics	ID	2	0	2	3
5	Management Courses	19EIE373	Operation Research	ID	2	0	2	3
6		19ECE371	Disaster Management	ID	2	0	2	3

### Interdisciplinary Elective II

S. No.	Stream	Course Code	Course Title	Category	L	T	P	C
1	Professional Courses	19EEC475	Microcontrollers and Interfacing	ID	2	0	2	3
2		19EEI471	Robotics & Automation	ID	2	0	2	3
3		19EEC473	Fundamentals of Digital Signal Processing	ID	2	0	2	3
4	Basic Science Courses	19EPH471	Quantum Computing	ID	2	0	2	3
5		19EBT463	Introduction To Bioinformatics	ID	2	0	2	3
6	Management Courses	19EME471	Optimization Techniques	ID	2	0	2	3

**Semester I**

<b>S.No</b>	<b>Course Code</b>	<b>Course Title</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>A</b>	<b>C</b>	<b>Remarks</b>
1.	19EMA101	Engineering Mathematics I (Calculus and Algebra)	BS	3	0	0	0	3	Common to all except BT
2.	GEL131	Communicative English	HS	2	0	2	0	3	Common to all
3.	19EPH131/ 19ECY131	Engineering Physics / Engineering Chemistry	BS/BS	3	0	3	0	4.5	Common to all
4.	19EID133	Problem Solving and Programming with Python	ES	3	1	3	0	5.5	Common to all
5.	19EME121/ 19EME131	Workshop / Engineering Graphics	ES/ES	0/1	0	3	0	1.5/2. 5	Common to all
6.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	NCC/NSS/NSO/YOGA	MC	0	0	2	0	0	Common to all
7.	19VDC111	Venture Discovery	ES	0	0	4	0	2	Common to all
<b>Total</b>								<b>19.5/20.5</b>	

# 19EMA101: ENGINEERING MATHEMATICS- I

## (CALCULUS AND ALGEBRA)

(Common to all branches of Engineering except Biotechnology)

<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

*This course is designed for the students of all B.Tech programmes except for Biotechnology as a prerequisite for the core programme. The course imparts concepts of calculus and matrix algebra that are essential in applications in solving engineering problems.*

### Course Objectives:

- To familiarize the students with the theory of matrices and quadratic forms.
- To explain the series expansions using mean value theorems.
- To teach basic concepts of partial derivatives.
- To explain the evaluation of double integrals and its applications.
- To demonstrate the evaluation and applications of triple integrals.

### UNIT I: Matrices

10 L

Rank of a matrix by echelon form, solving system of homogeneous and non-homogeneous linear equations, eigen values, eigenvectors and their properties, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix, quadratic forms and nature of the quadratic forms, reduction of quadratic form to canonical forms by orthogonal transformation.

### Learning Outcomes:

After completion of this unit, the student will be able to

- solve system of homogeneous and non-homogeneous linear equations (L3)
- find the eigenvalues and eigenvectors of a matrix (L3)
- identify special properties of a matrix (L3)

### UNIT II: Mean Value Theorems

6 L

Rolle's theorem, Lagrange's mean value theorem, Cauchy's mean value theorem, Taylor's and Maclaurin's theorems with remainders (without proof).

### Learning Outcomes:

After completion of this unit, the student will be able to

- demonstrate the given function as series of Taylor's and Maclaurin's with remainders (L2)
- illustrate series expansions of functions using mean value theorems (L2)

### UNIT III: Multivariable Calculus

8 L

Partial derivatives, total derivatives, chain rule, change of variables, Jacobian, maxima and minima of functions of two variables, method of Lagrange multipliers.

**Learning Outcomes:**

After completion of this unit, the student will be able to

- interpret partial derivatives as a function of several variables (L2)
- apply Jacobian concept to deal with the problems in change of variables (L3)
- evaluate maxima and minima of functions (L3)

**UNIT IV: Multiple Integrals-I****8 L**

Double integrals, change of order of integration, double integration in polar coordinates, area enclosed by plane curves.

**Learning Outcomes:**

After completion of this unit, the student will be able to

- apply double integrals in cartesian and polar coordinates (L3)
- calculate the areas bounded by a region using double integration techniques (L3)

**UNIT V: Multiple Integrals-II****8 L**

Evaluation of triple integrals, change of variables (cartesian, cylindrical and spherical polar co-ordinates), volume as triple integral.

**Learning Outcomes:**

After completion of this unit, the student will be able to

- apply multiple integrals in cartesian, cylindrical and spherical geometries (L3)
- evaluate volumes using triple integrals (L3)

**Text Book(s):**

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2018.
2. B. S. Grewal, Higher Engineering Mathematics, 44/e, Khanna Publishers, 2017.

**References:**

1. R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.
2. George B. Thomas, Maurice D. Weir and Joel R. Hass, Thomas, Calculus, 13/e, Pearson Publishers, 2014.
3. Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson Publishers, 2011.

**Course Outcomes:**

After completion of this unit, the student will be able to

- utilize the techniques of matrix algebra for practical applications(L3)
- apply mean value theorems to engineering problems (L3)
- utilize functions of several variables in optimization (L3)
- employ the tools of calculus for calculating the areas (L3)
- calculate volumes using multiple integrals (L3)

**GEL131: COMMUNICATIVE ENGLISH**  
**(Common to all)**

**L T P C**  
**2 0 2 3**

*The course is a unified approach to enhance language skills of learners with an aim to hone their social skills and to increase their employability. The course is designed to acquaint the learners with the necessary LSRW (Listening/ Speaking / Reading/ Writing) skills needed either for recruitment or further studies abroad for which they attempt international exams like TOEFL, IELTS and GRE. It enables the learners improve their communication skills which are crucial in an academic environment as well as professional and personal lives.*

**Course Objectives:**

- To enable learners to develop listening skills for better comprehension of academic presentations, lectures and speeches.
- To hone the speaking skills of learners by engaging them in various activities such as just a minute (JAM), group discussions, oral presentations, and role plays.
- To expose learners to key Reading techniques such as Skimming and Scanning for comprehension of different texts.
- To acquaint the learners with effective strategies of paragraph and essay writing, and formal correspondence such as email, letters and resume.
- To provide learners with the critical impetus necessary to forge a path in an academic environment, in the professional life and in an increasingly complex, interdependent world.

**UNIT I**

**8L**

Listening: Listening for gist and specific information, speaking: Introducing self and others; Developing fluency through JAM, Reading: Skimming for gist and Scanning for specific information, Writing: Paragraph writing-writing coherent and cohesive paragraph (narrative and descriptive); use of appropriate Punctuation. Grammar & Vocabulary: Articles & Prepositions; Word Families (Verbs, Nouns, Adjectives, Adverbs; Prefixes and Suffixes)

**Learning Outcomes:**

After completion of this unit, the student will be able to

- apply the requisite listening skills and comprehend at local and global level. (L5)
- introduce themselves with accurate structure in diverse social and professional contexts. (L2)
- apply relevant reading strategies for comprehension of any given text(L3)
- write a paragraph using cohesive devices maintaining coherence (L3)
- understand the use of Articles and Prepositions, and apply appropriately for meaningful communication (L3)
- understand the relevance of various categories in word family and apply them meaningfully in context (L3)

## UNIT II

10L

Listening: Listening for Note taking and Summarizing, Speaking: Role plays and Oral Presentations, Reading: Intensive Reading-Reading for implicit meaning, Writing: Note making and summarizing, Grammar & Vocabulary: Verb Forms-Tenses; synonyms to avoid repetition in speech and writing.

### Learning Outcomes:

After completion of this unit, the student will be able to

- employ note taking and summarizing strategies to comprehend the listening text (L2)
- use strategies for successful and relevant oral presentation (L4)
- demonstrate effective communication skills by applying turn-taking and role distribution techniques for meaningful and contextual Speaking (L4)
- apply various reading strategies imbibing inferential and extrapolative comprehension of any given text. (L3)
- apply various note-making techniques while comprehending the reading text to present a complete and concise set of structured notes (L5)
- apply the notes to draft a summary (L3)
- use correct tense forms and appropriate structures in speech and written communication (L3)
- context specific use of Prefixes and Suffixes for meaningful communication (L3)

## UNIT III

8L

Listening: Listening for presentation strategies: introducing the topic, organization of ideas, conclusion. Speaking: Aided presentations, Reading: Inferring using textual clues, Writing: Formal Letter and Email writing, Grammar & Vocabulary: Active and Passive Voice; linkers and discourse markers.

### Learning Outcomes:

After completion of this unit, the student will be able to

- notice and understand effective listening strategies to identify discourse markers in presentations. (L2)
- make formal oral presentations using effective strategies such as audio – visual aids (L3)
- infer meaning and inter – relatedness of ideas (L4)
- understand relevant structures and draft formal letters in suitable format (L4)
- construct relevant sentences in active and passive voice for meaningful communication (L3)
- comprehend and apply available vocabulary items relevant to the context (L3)

## UNIT IV

10L

Listening: Listening for labeling-maps, graphs, tables, illustrations, Speaking: Aided group presentation using charts, graphs etc. Reading: Reading for identification of facts and opinions, Writing: Information transfer (writing a brief report based on information from graph/chart/table), Grammar & Vocabulary: Subject-verb agreement; language for comparison and contrast; Antonyms.

## Learning Outcomes:

After completion of this unit, the student will be able to

- match visual and auditory inputs and use the information comprehensively and adequately demonstrate important relationships or patterns between data points (L2)
- choose and coordinate resources appropriate to context and speak intelligibly (L4)
- develop advanced reading skills for analytical and extrapolative comprehension (L5)
- make decisions on arrangement of ideas and transfer them from visual to verbal form using context appropriate structure. (L4)
- demonstrate ability to use task specific grammatically correct structures (L3)
- Comprehend and use expressions for negation/contradiction (L3)

## UNIT V

8L

Listening: Listening to discussions for opinions, Speaking: Group Discussion, Reading: Reading for inferences, Writing: Guided essay writing (argumentative) , Grammar & Vocabulary: Editing short texts: correcting common errors in grammar and usage; Action verbs for fluency and effective writing.

## Learning Outcomes:

After completion of this unit, the student will be able to

- apply analytical and problem-solving strategies to identify and interpret facts and opinions from a dialogue. (L3)
- able to administer group dynamics to contribute valid ideas to a discussion with clarity and precision (L3)
- demonstrate techniques to analyze contextual clues(L4)
- compare and correlate ideas and facts to produce an organized essay with adequate supporting evidences (L5)
- organize the available structural/grammatical knowledge and apply them in a real time context (L3)
- comprehend meaning for new words/phrases used and apply them in a new context. (L3)

## Reference Book(s):

1. .Arosteguy, K.O. and Bright, A. and Rinard, B.J. and Poe, M”, A Student's Guide to Academic and Professional Writing in Education”, UK, Teachers College Press,2019.
2. Raymond Murphy, “English Grammar in Use A Self-Study Reference and Practice Book for Intermediate Learners of English, Cambridge University Press,2019.
3. Peter Watkins,” Teaching and Developing Reading Skills”, UK, CUP, 2018 .
4. Deeptha Achar et al., “Basic of Academic Writing” (1and 2) parts New Delhi: Orient BlackSwan, (2012& 2013).

5. Kumar S and Lata P, “Communication Skills”, New Delhi Oxford University Press, 2015.

### **Course Outcomes**

By the end of the course, the Student will be able to

- think critically, analytically, creatively and communicate confidently in English in social and professional contexts with improved skills of fluency and accuracy. (L3)
- write grammatically correct sentences employing appropriate vocabulary suitable to different contexts. (L3)
- comprehend and analyze different academic texts. (L4)
- make notes effectively and handle academic writing tasks such as Paragraph writing and Essay writing. (L3)
- effectively handle formal correspondence like e-mail drafting and letter writing. (L3)

**19EPH131: ENGINEERING PHYSICS**  
**(Common with ECE & EEE)**

**L T P C**  
**3 0 3 4.5**

*This course is designed with fundamentals of electromagnetism and properties of materials for advanced courses in their respective engineering branches. It introduces electromagnetic theory with relevant mathematical tools, optical fibers and their propagation characteristics, properties of dielectric and magnetic materials. It also introduces principles of semiconductors and some widely used semiconductor devices for various applications.*

**Course Objectives**

- To introduce mathematical principles to estimate forces, fields and waves.
- To familiarize students with electromagnetics in modern communication systems.
- To impart knowledge concerning the electrical behaviour of dielectric materials.
- To demonstrate the properties of magnets.
- To introduce semiconductor physics and devices.

**UNIT I: Basics of Electromagnetics**

**9 L**

**Electrostatic field:** Coulomb's law and Gauss' law, derivation of Coulombs law from Gauss' law, applications of Gauss' law (line charge, thin sheet of charge and solid charged sphere), Gauss' law of electrostatics in dielectric medium, divergence and curl of electric fields, electric potential, relation between potential and force, Poisson's and Laplace equations.

**Magnetostatic field:** Biot–Savarts' law, divergence and curl of magnetic fields, Faraday's and Ampere's laws in integral and differential form, displacement current, continuity equation, Maxwell's equations.

**Learning outcomes:**

After completion of this unit, the student will be able to

- apply Coulomb's and Gauss' laws to electric field configurations from charge distributions (L3)
- apply the Biot-Savarts' law to derive magnetostatic field distributions (L3)
- use vector calculus to describe electromagnetic phenomena (L2)
- relate the law of conservation of charge to continuity equation (L3)
- illustrate the Maxwell's equations, Maxwell's displacement current and correction of Ampere's law (L2)

**UNIT II: Fiber Optics**

**7 L**

Introduction, advantages of optical fibers, principle and structure, acceptance angle, numerical aperture, modes of propagation, classification of fibers, fiber optic communication, importance of V-number, fiber optic sensors (Temperature, displacement and force), applications.

**Learning outcomes:**

After completion of this unit, the student will be able to

- apply the principle of propagation of light in optical fibers (L3)
- explain the working and classification of optical fibers (L2)
- analyze propagation of light through optical fibers based on the concept of modes (L4)

- summarize applications of optical fibers in medical, communication and other fields (L2)

### UNIT III: Dielectric and Magnetic Materials

10 L

**Dielectric materials:** Introduction, electric polarization, dielectric polarizability, susceptibility and dielectric constant, types of polarizations (qualitative treatment only), frequency dependence of polarization, Lorentz (internal) field (quantitative), Clausius- Mossotti equation.

**Magnetic materials:** Introduction, magnetic dipole moment, magnetization, magnetic susceptibility and permeability, origin of permanent magnetic moment, classification of magnetic materials, Weiss theory of ferromagnetism (qualitative), domain theory, hysteresis, soft and hard magnetic materials.

#### Learning Outcomes:

After completing this unit, the students will be able to

- explain the concept of dielectric constant and polarization in dielectric materials (L2)
- interpret dielectric loss, Lorentz field and Claussius- Mosotti relation (L2)
- classify the magnetic materials (L2)
- explain the phenomenon of hysteresis for a ferromagnetic material and summarize the properties of hard and soft magnetic materials (L2)

### UNIT IV: Semiconductor physics

8 L

Introduction, origin of energy band, intrinsic and extrinsic semiconductors, mechanism of conduction in intrinsic semiconductors, generation and recombination, carrier concentration in intrinsic semiconductors, variation of intrinsic carrier concentration with temperature, n-type and p-type semiconductors, carrier concentration in n-type and p-type semiconductors.

#### Learning outcomes:

After completion of this unit, the student will be able to

- outline the properties of semiconductors (L2)
- interpret expressions for carrier concentration in intrinsic and extrinsic semiconductors (L2)
- assess the variation of carrier concentration in semiconductors with
- temperature (L5)

### UNIT V: Semiconductor devices

8 L

Drift and diffusion currents in semiconductors, Hall effect and its applications, magnetoresistance, p-n junction layer formation and V-I characteristics, direct and indirect band gap semiconductors, construction and working of photodiode, LED, solar cell.

#### Learning Outcomes:

After completion of this unit, the student will be able to

- explain the drift and diffusion currents and formation of junction layer (L2)
- state Einstein's relations (L1)
- explain Hall effect and its applications (L3)
- illustrate and interpret the V-I characteristics of a p-n junction diode(L2)
- describe applications of p-n junction diodes in photodiodes, LEDs and solar cells (L3).

### **Text Book(s)**

1. David J.Griffiths,“IntroductiontoElectrodynamics”,4/e, Pearson Education, 2014.
2. Charles Kittel, “Introduction to Solid State Physics”, Wiley Publications,2011.

### **Reference book(s)**

1. M.N. Avadhanulu, P.G. Kshirsagar, “A Text book of Engineering Physics”, 11/e, S. Chand Publications,2019.
2. Gerd Keiser, “Optical Fiber Communications”, 4/e, Tata Mc Graw Hill, 2008.
3. S.O. Pillai, “SolidStatePhysics”,8/e, NewAgeInternational,2018.
4. S.M. Sze, “Semiconductor Devices-Physics and Technology”, Wiley, 2008.

## **Engineering Physics Laboratory**

### **List of Experiments**

1. To determine the magnetic field along the axis of a circular coil carrying current.
2. To determine the numerical aperture of a given optical fiber and hence to find its acceptance angle
3. To determine magnetic susceptibility by Gouy’s method
4. To determine the Hall coefficient using Hall effect experiment
5. To determine the resistivity of semiconductor by Four probe method
6. To determine the energy gap of a semiconductor.
7. To study the characteristics of PN Junction diode.
8. To study magnetic hysteresis loop (B-H curve).
9. To determine the dielectric constant of a substance by resonance method.
- 10.To determine hysteresis loss by CRO.
- 11.To study the characteristics of Photodiode
- 12.To study the characteristics of Solar Cell

### **References**

1. S. Balasubramanian, M.N. Srinivasan “A Text book of Practical Physics”- S Chand Publishers, 2017

### **Course Outcomes**

After completion of this unit the student will be able to

- utilize four probe set up and measure resistance (L3)
- determine the susceptibility of a paramagnetic substance (L5)
- understand the characteristics of photodiode, p-n junction diode and solar cell (L2).
- demonstrate the importance of dielectric material in storage of electric field energy in the capacitors (L2)

- assess the intensity of the magnetic field of circular coil carrying current with varying distance (L5)
- evaluate the acceptance angle of an optical fiber and numerical aperture and loss (L5).
- determine hysteresis losses by B-H curve and measure magnetic parameters using hysteresis loop (L5).
- identify the type of semiconductor i.e., n-type or p-type using Hall effect (L3)
- determine the band gap of a given semiconductor (L5)

**19ECY131: ENGINEERING CHEMISTRY**  
**(Common with ECE & EEE)**

**L T P C**  
**3 0 3 4.5**

*This course enables the students to gain knowledge on various aspects of renewable energy resources, electrochemical energy systems, construction of batteries, technological importance machining and etching, polymers, nano-materials, molecular machines and switches. The knowledge gained in this course can be applied to the latest problems in the above areas.*

**Course Objectives**

- To acquaint with electrochemical energy systems and their applications.
- To impart knowledge on the basic concepts of battery technology.
- To familiarize the students with various sources of renewable energy and their harnessing.
- To demonstrate the construction of photovoltaic cells.
- To introduce different types of nano-materials.
- To expose the students to latest instrumental techniques such as scanning electronic microscope (SEM) & transmission electron microscope (TEM).

**UNIT I**

**9L**

**Electrochemical Energy Systems**

Introduction Origin of electrode potential, Electrode Potentials, Measurement of Electrode Potentials, Nernst Equation for a single electrode, EMF of a cell, Types of Electrodes or Half Cells Hydrogen and Calomel electrode, Electrochemical Cell, Galvanic Cell vs. Electrolytic Cell, Electrochemical conventions, Types of Ion Selective Electrodes- glass membrane electrode, polymer membrane electrodes, solid state electrodes, gas sensing electrodes (classification only), Concentration Cells.

**Learning outcomes:**

After the completion of the Unit I, the student will be able to

- list the different types of electrodes. (L1)
- illustrate the construction of concentration cells. (L2)
- explain the significance of electrode potentials. (L2)
- compare different types of cells and batteries. (L2)
- classify the ion selective electrodes. (L2)

**UNIT II**

**8L**

**Battery Technology**

Basic concepts, battery characteristics, classification of batteries, Important applications of batteries, Classical batteries-dry/Leclanche cell, Modern batteries-zinc air, lithium cells-Li MnO<sub>2</sub> cell- challenges of battery technology. Fuel cells Introduction - classification of fuel cells – hydrogen and oxygen fuel cell, propane and oxygen fuel cell- Merits of fuel cell.

**Learning outcomes:**

After the completion of the Unit II, the student will be able to

- classify batteries into different types. (L2)
- explain the concept involved in the construction of lithium cells. (L2)
- compare the merits of different fuel cells. (L2)
- identify the significance of batteries. (L3)
- apply the redox principles for construction of batteries and fuel cell. (L3)

**UNIT III****8L****Renewable Sources of Energy Introduction- sources of renewable energy**

**Solar energy** – Introduction - Physical and Chemical properties of Silicon- Production of Solar Grade Silicon from Quartz - Doping of Silicon- p and n type semiconductors- PV cell / solar cell- Manufacturing of Photovoltaic Cells using Chemical Vapor Deposition Technique-applications of solar energy.

**Learning outcomes:**

After the completion of the Unit III, the student will be able to

- list different renewable sources of energy. (L1)
- explain how photovoltaic cells convert light into energy. (L1)
- compare p and n type semiconductors. (L2)
- illustrate the construction of PV cell. (L2)

**UNIT IV****9L****Metal Finishing**

Technological importance of metal finishing, methods of metal finishing, manufacturing of electronic components, electrochemical techniques of forming, machining and etching, electrolytic cell, principle of electroplating, nature of electrodeposits, electroplating process, Electroplating of chromium, gold etc. Electroless plating of copper, nickel.

**Learning outcomes:**

After the completion of the Unit IV, the students will be able to

- explain the electrochemical techniques of forming. (L2)
- extend it to electroless plating of some metals. (L2)
- identify different methods of metal finishing. (L3)
- apply the methods of metal finishing in the manufacture of electronic components. (L3)

**UNIT V****8L****Polymers, Nanomaterials and Molecular Machines & Switches:**

**Polymers:** Introduction, differences between thermoplastic and thermo setting resins, Preparation, properties and uses of polystyrene and Poly phosphazines.

**Nanomaterials:** Introduction to nanomaterial: nanoparticles, nanocluster, carbon nanotube (CNT) and

nanowires. Chemical synthesis of nanomaterials: sol-gel method. Characterization: Principle and applications of scanning electron microscope (SEM) and transmission electron microscope (TEM).

**Molecular machines & Molecular switches:** Rotaxanes and Catenanes as artificial molecular machines; Molecular switches – cyclodextrin-based switches

**Learning outcomes:**

After the completion of the Unit V, the students will be able to

- explain the concepts of artificial molecular machines and molecular switches. (L2)
- identify different types of polymers. (L3)
- distinguish between thermoplastic and thermo setting resins. (L4)
- compare nanoclusters and nanowires. (L4)

**Text Book(s):**

1. P.C. Jain and M. Jain, Engineering Chemistry, 15/e, Dhanapat Rai & Sons, Delhi ,2014.
2. B.K. Sharma, Engineering Chemistry, Krishna Prakashan, Meerut.
3. G Palanna, Engineering Chemistry, Tata McGraw Hill 2009.

**References:**

1. Sashichawla, A Textbook of Engineering Chemistry, Dhanapath Rai and sons,2003.
2. B.S Murthy and P. Shankar, A Text Book of Nano Science and Nano Technology, University Press, 2013.
3. S.S. Dara, A Textbook of Engineering Chemistry, S. Chand & Co, 2010.
4. N. Krishna Murthy and Anuradha , A text book of Engineering Chemistry, Murthy Publications,2014.
5. K. Sessa Maheshwaramma and Mridula Chugh, Engineering Chemistry, Pearson India Edn services, 2016.

**Course Outcomes**

After the completion of the course, the student will be able to

- list various sources of renewable energy. (L1)
- compare different types of cells. (L2)
- explain the merits of fuel cells. (L2)
- identify suitable methods for metal finishing. (L3)
- distinguish between nanoclusters and nanowires, polymers, molecular machines & switches(L4)

## Engineering Chemistry Laboratory

*The course enables the students to gain knowledge on various, instrumental methods of analysis, measurements of physical parameters, volumetric analysis, preparation of polymers, analysis of water, and chromatographic separation techniques.*

### Course Objectives

- To familiarize the students with the basic concepts of Engineering Chemistry lab.
- To train the students on how to handle the instruments.
- To demonstrate the digital and instrumental methods of analysis.
- To expose the students in practical aspects of the theoretical concepts.

### List of Experiments

1. Determination of Mohr's salt by potentiometric method
2. Determination of strength of an acid by pH metric method
3. Determination of conductance by conductometric method
4. Determination of viscosity of a liquid
5. Determination of surface tension of a liquid
6. Determination of sulphuric acid in lead-acid storage cell
7. Determination of chromium (VI) in potassium dichromate
8. Determination of copper in a copper ore
9. Determination of Zinc by EDTA method.
10. Estimation of active chlorine content in Bleaching powder
11. Preparation of Phenol-Formaldehyde resin
12. Preparation of Urea-Formaldehyde resin
13. Thin layer chromatography
14. Preparation of  $\text{TiO}_2/\text{ZnO}$  nano particles
15. SEM analysis of nano materials

### Text Books

1. Mendham J, Denney RC, Barnes JD, Thomas M and Sivasankar B , Vogel's Quantitative Chemical Analysis, 6/e, Pearson publishers, 2000.
2. N.K Bhasin and SudhaRani Laboratory Manual on Engineering,
3. Chemistry, 3/e, Dhanpat Rai Publishing Company, 2007.

### Course Outcomes:

After the completion of the laboratory course, the student will be able to

- explain the functioning of the instruments such as pH, Conductometric and Potentiometric methods. (L2)
- identify different ores (Cr & Cu) and their usage in different fields (industry, software devices, electronic goods). (L3)
- experiment with the physical parameter of organic compounds. (L3)
- compare the viscosities of oils. (L4)
- list the preparation of polymers and nano materials. (L4)

# 19EID133: PROBLEM SOLVING AND PROGRAMMING WITH PYTHON

(Common to all)

L T P C  
3 1 3 5.5

*This course focuses on problem solving using visual programming and flowchart tools. Python being simple and easy to learn syntax, it is used as an introductory coding platform to translate flow charts into programs. The course introduces fundamental programming concepts. Python language is used to present concepts including control structures, functions, data structures followed by important Python packages that will be useful in data analysis.*

## Course Objectives:

- To introduce programming through Visual programming tool - Scratch
- To teach problem solving through Flow charting tool - Raptor
- To elucidate problem solving through python programming language
- To introduce function-oriented programming paradigm through python
- To train in development of solutions using modular concepts
- To teach practical Pythonic solution patterns

## UNIT I: Computational Thinking and Visual Programming Concepts

10 L+6P

Introduction to computational thinking. Visual programming concepts. Scratch environment: sprites -- appearance and motion, angles and directions, repetition and variation, changing costumes, adding background. Input/Output, variables and operators.

### Learning Outcomes

After completion of this unit the student will be able to

- develop a program, controlled by a loop. (L3)
- experiment with “costumes” to change the appearance of sprites. (L3)
- perform Input, Output Operations using scratch. (L3)
- perform computation using common mathematical formulas. (L3)
- develop programs by passing messages between sprites. (L3)

## UNIT II: Algorithms and Flowchart design through Raptor

10L+6P

Introduction to the idea of an algorithm. Pseudo code and Flow charts. Flow chart symbols, Input/Output, Assignment, operators, conditional if, repetition, procedure and sub charts.

Example problems – Finding maximum of 3 numbers, Unit converters, Interest calculators, multiplication tables, GCD of 2 numbers

Example problems -- Fibonacci number generation, prime number generation. Minimum, Maximum and average of n numbers, Linear search, Binary Search.

### Learning outcomes:

After completion of this unit the student will be able to

- select flowchart symbols for solving problems. (L1)

- develop basic flowcharts for performing Input, Output and Computations (L3)
- solve numerical problems using Raptor (L3)
- analyze problems by modular approach using Raptor (L4)

### **UNIT III: Introduction to Python**

**10L+6P**

Python – Numbers, Strings, Variables, operators, expressions, statements, String operations, Math function calls, Input/Output statements, Conditional If, while and for loops, User defined Functions, parameters to functions, recursive functions, Turtle Graphics.

#### **Learning outcomes:**

After completion of this unit the student will be able to

- interpret numbers, strings, variables, operators, expressions and math functions using Python Interactive Mode. (L2)
- solve simple problems using control structures, input and output statements. (L3)
- develop user defined functions (recursive and non-recursive). (L3)
- build Python programs for section 1 raptor flowcharts. (L3)
- develop Python programs for creating various graphical shapes using turtle graphics. (L3)

### **UNIT IV: Data Structures and Idiomatic Programming in Python**

**10L+6P**

Lists, Tuples, Dictionaries, Strings, Files and their libraries. Beautiful Idiomatic approach to solve programming problems.

#### **Learning outcomes:**

After completion of this unit the student will be able to

- summarize the features of lists, tuples, dictionaries, strings and files. (L2)
- demonstrate best practices of “Beautiful Idiomatic Python”. (L2)
- build Python programs for section 2 raptor flowcharts. (L3).

### **UNIT V: Packages**

**10L+6P**

Numpy -- Create, reshape, slicing, operations such as min, max, sum , search, sort, math functions etc.

Pandas -- Read/write from csv, excel, json files, add/ drop columns/rows, aggregations, applying functions

Matplotlib -- Visualizing data with different plots, use of subplots.

User defined packages, define test cases and perform unit testing

#### **Learning outcomes:**

After completion of this unit the student will be able to

- read data from files of different formats and perform operations like slicing, insert, delete, update (L3)
- visualize the data (L4)
- ability to define packages (L2)
- define test cases (L1)

## Problem Solving and Programming with Python Laboratory

### Laboratory Experiments

1. Design a script in Scratch to make a sprite to draw geometrical shapes such as Circle, Triangle, Square, Pentagon.
2. Design a script in Scratch to make a sprite to ask the user to enter two different numbers and an arithmetic operator and then calculate and display the result.
3. Design a Memory Game in Scratch which allows the user to identify positions of similar objects in a 3 x 3 matrix.
4. Construct flowcharts to
  - a. calculate the maximum, minimum and average of N numbers
  - b. develop a calculator to convert time, distance, area, volume and temperature from one unit to another.
5. Construct flowcharts with separate procedures to
  - a. calculate simple and compound interest for various parameters specified by the user
  - b. calculate the greatest common divisor using iteration and recursion for two numbers as specified by the user
6. Construct flowcharts with procedures to
  - a. generate first N numbers in the Fibonacci series
  - b. generate N Prime numbers
7. Design a flowchart to perform Linear search on list of N unsorted numbers (Iterative and recursive)
8. Design a flowchart to perform Binary search on list of N sorted numbers (Iterative and recursive)
9. Design a flowchart to determine the number of characters and lines in a text file specified by the user
10. Design a Python script to convert a Binary number to Decimal number and verify if it is a Perfect number.
11. Design a Python script to determine if a given string is a Palindrome using recursion
12. Design a Python script to sort numbers specified in a text file using lists.
13. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format ( $0 \leq \text{YYYY} \leq 9999$ ,  $1 \leq \text{MM} \leq 12$ ,  $1 \leq \text{DD} \leq 31$ ) following the leap year rules.
14. Design a Python Script to determine the Square Root of a given number without using inbuilt functions in Python.
15. Design a Python Script to determine the time difference between two given times in HH:MM:SS format. ( $0 \leq \text{HH} \leq 23$ ,  $0 \leq \text{MM} \leq 59$ ,  $0 \leq \text{SS} \leq 59$ )
16. Design a Python Script to find the value of (Sine, Cosine, Log, PI,  $e$ ) of a given number using infinite series of the function.
17. Design a Python Script to convert a given number to words.
18. Design a Python Script to convert a given number to roman number.
19. Design a Python Script to generate the frequency count of words in a text file.
20. Design a Python Script to print a spiral pattern for a 2 dimensional matrix.
21. Design a Python Script to implement Gaussian Elimination method.
22. Design a Python script to generate statistical reports (Minimum, Maximum, Count, Average, Sum etc) on public datasets.
23. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorizing them into distinction, first class, second class, third class and failed.

**Text Book(s):**

1. Weingart, Dr. Troy, Brown, Dr. Wayne, An introduction to programming and algorithmic reasoning using raptor.
2. T R Padmanabhan, Programming with python, Springer.
3. Reema Thareja, Python Programming: Using Problem Solving Approach, Oxford University Press.
4. Wes McKinney , Python for Data Analysis, O.Reilly.

**Course outcomes:**

**After the completion of the course, the student will be able to**

- create interactive visual programs using Scratch. (L6)
- develop flowcharts using raptor to solve the given problems. (L3)
- build Python programs for numerical and text based problems (L3)
- develop graphics and event based programming using Python (L3)
- build Python programs using beautiful Pythonic idiomatic practices (L3)

**19EME121: WORKSHOP**  
**(Common to all)**

**L T P C**  
**0 0 3 1.5**

*The objective of this course is to expose students, common tools in engineering. This course enables the students to gain hands on experience and skills necessary to perform basic operations such as carpentry, sheet metal working and fitting. It also familiarizes the students with basic electrical house wiring concepts.*

**Course Objectives**

- Explain different tools used in carpentry.
- Impart the skills to do some carpentry operations.
- Demonstrate different types of tools used in fitting, soldering and brazing.
- Train fitting, soldering and brazing jobs.
- Familiarize different types of basic electric circuit connections.

**Wood Working:**

Familiarity with different types of woods and tools used in wood working and make following joints

- a) Half – Lap joint.
- b) Mortise and Tenon joint.
- c) Corner Dovetail joint or Bridle joint.

**Sheet Metal Working:**

Familiarity with different types of tools used in sheet metal working,  
Developments of following sheet metal job from GI sheets

- a) Tapered tray
- b) Conical funnel
- c) Elbow pipe
- d) Brazing

**Fitting:**

Familiarity with different types of tools used in fitting and do the following fitting exercises

- a) V-fit
- b) Dovetail fit
- c) Semi-circular fit
- d) Bicycle tire puncture and change of two wheeler tire

**Electrical Wiring:**

Familiarities with different types of basic electrical circuits and make the following connections

- a) Parallel and series
- b) Two-way switch
- c) Godown lighting
- d) Tube light
- e) Three phase motor
- f) Soldering of wires

**Course Outcomes:**

After completion of this lab the student will be able to

- summarize various carpentry operation required to create a product in real time applications. (L2)
- develop different parts with metal sheet in real time applications. (L3)
- demonstrate fitting operations in various applications. (L3)
- preform soldering and brazing operations. (L3)
- select different types of electric circuits in practical applications (L3)

**19EME131: ENGINEERING GRAPHICS**  
(Common to all)

**L T P C**  
**1 0 3 2.5**

*This course enables the students to convey the ideas and information graphically that come across in engineering. This course includes projections of lines, planes, solids sectional views, and utility of drafting and modeling packages in orthographic and isometric drawings.*

**Course Objectives**

- Create awareness of the engineering drawing as the language of engineers.
- Familiarize how industry communicates, practices for accuracy in presenting the technical information.
- Develop the engineering imagination essential for successful design.
- Demonstrate utility of drafting and modeling packages in orthographic and isometric drawings.
- Train the usage of 2D and 3D modeling softwares.
- Impart graphical representation of simple components.

**Manual Drawing:**

**7 L**

**Introduction to Engineering graphics:** Principles of Engineering Graphics and their Significance- Conventions in drawing-lettering - BIS conventions.

- a) Conic sections - general method only,
- b) Cycloid, epicycloids and hypocycloid
- c) Involute

**2L**

**Projection of points, lines and planes:** Projection of points in different quadrants, lines inclined to one and both the planes, finding true lengths and angles made by line. Projections of regular plane surfaces.

**2L**

**Projections of solids:** Projections of regular solids inclined to one and both the reference planes.

**1L**

**Sections of solids:** Sectional planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

**1L**

**Development of surfaces:** Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

**1L**

**Computer Aided Drafting:**

**Introduction to AutoCAD:** Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions. Dimensioning principles and conventional representations.

**1L**

**Orthographic Projections:** Systems of projections, conventions and application to orthographic projections.

**3L**

**Isometric Projections:** Principles of isometric projection- Isometric

scale; Isometric views: lines, planes, simple and compound solids.

**2L**

**Text Book(s):**

1. K.L. Narayana & P. Kannaiah, Engineering Drawing, 3/e, SciTech Publishers, 2012.
2. N.D. Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

**References:**

1. Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, 2009.
2. Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009.
3. Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000.
4. K.C. John, Engineering Graphics, 2/e, PHI, 2013.
5. Basant Agarwal and C.M. Agarwal, Engineering Drawing, Tata McGraw Hill, 2008.

**Course Outcomes:**

After completion of this unit the student will be able to

- utilize Engineering Graphics as Language of Engineers. (L3)
- prepare drawings as per standards (BIS). (L3)
- identify various engineering curves. (L3)
- solve geometrical problems in plane geometry involving lines and plane figures (L3)
- represent solids and sections graphically. (L3)
- develop the surfaces of solids. (L3)
- draw isometric and orthographic drawings using CAD packages. (L3)

## 19EMC181A – NATIONAL CADET CORPS

L T P C  
0 0 2 0

### UNIT I

5 hours

**Aims and objectives of NCC:** Organization and training, ncc song, incentives for cadets. national integration and awareness: religion, culture, traditions and customs of india, national integration – importance and necessity, freedom struggle and nationalist movement in india, national interests, objectives, threats and opportunities, problems/ challenges of national integration, national integration and awareness, unity and diversity, national integration council, images/ slogans for national integration, contribution of youth in nation building

### UNIT II

5 hours

Drill Attention, stand at ease and stand easy, turning and inclining at the at the halt, ceremonial drill-guard mounting, guard of honour, platoon / company drill, instructional practice, weapon training stripping, assembling, care and cleaning and sight setting of .22 rifle, the lying position, holding and aiming, trigger control and firing a shot, short range firing, aiming – alteration of sight

### UNIT III

5 hours

Personality development: Introduction to personality development, factors influencing / shaping personality – physical , social, psychological and philosophical self-awareness – know yourself / insight, change your mindset, interpersonal relationship and communication communication skills – group discussion / lecturettes, leadership traits, types of leadership, attitude – assertiveness and negotiation, time management, personality development, effects of leadership with historical examples, stress management skills, interview skills, conflict motives – resolution, importance of group – team work, influencing skills, body language, sociability: social skills, values / code of ethics **Disaster Management:** Civil defence organization and its duties – ndma, types of emergencies / natural disasters, fire service and fire fighting, traffic control during disaster under police supervision, essential services and their maintenance, assistance during natural / other calamities / floods / cyclone / earth quake / accident, setting up of relief camp during disaster management, collection and distribution of aid material

### UNIT IV

5 hours

**Social awareness and community development:** Basics of social service, weaker sections of our society and their needs, social/ rural development projects – menrega , sgsy , nsap etc, ngos : role and contribution, contribution of youth towards social welfare, family planning, drug abuse and trafficking, civil responsibilities, causes and prevention of hiv/ aids role of youth, counter terrorism, corruption, social evils – dowry / female foeticide / child abuse and trafficking, rti and rte, traffic control organization and anti drunken driving, provision of protection of children from sexual harassment act 2012.

### UNIT V

5 hours

**Health and Hygiene:** Structure and functioning of the human body, hygiene and sanitation (personal and food hygiene), physical and mental health, infectious and contagious diseases and its prevention, basic of home nursing and first aid in common medical emergencies, wounds and fractures, introduction to yoga and exercises. **Adventure training:** Para sailing, slithering, rock climbing, cycling / trekking, environment awareness and conservation natural resources conservation and management, water conservation and rain

water harvesting, waste management, pollution control, water , air, noise and soil, energy conservation,, wildlife conservation – projects in india. obstacle training, obstacle course, practical training

**Text Book(s)**

1. Cadet Hand Book (Common Subjects), published by DG NCC.
2. Cadet Hand Book (Specialized Subjects), published by DG NCC.

**Reference Book(s)**

1. Grooming Tomorrow's Leaders, published by DG, NCC.
2. Youth in Action, published by DG, NCC.
3. The Cadet, Annual Journal of the NCC.

## 19EMC181B - NATIONAL SERVICE SCHEME (NSS)

L T P C  
0 0 2 0

*National Service scheme is a public service program encouraged by Ministry of Youth Affairs[1] and Sports of the Government of India. NSS is a voluntary association of young people in Colleges, Universities and at +2 level working for a campus-community linkage. The objective of this course is to expose the students to the activities of National Service Scheme, concept of social Service and principles of health, hygiene and sanitation.*

### UNIT I

2Hours

**Introduction and Basic concepts of NSS:** History. Philosophy, aims and Objectives of NSS, Emblem, Flag, Motto, Song, Badge etc.: Organizational structure, role and responsibilities of various NSSFunctionaries.

### UNIT II

2Hours

**Regular activities:** College campus activities, NS.S, activities in Urban and Rural areas, NSS Annual Activities Calendar, Suggestive List of Activities, Role of Non-Government Organization (NGO) in social Reforms i) Red Cross ii) Rotary

### UNIT III

2Hours

**Special Camp activities: Nature and its objectives:** Selection of camp site -Identification of community problems- physical arrangement- Organization of N.S.S.camp through various committees and discipline in the camp- adaption of village-planning for pre -camp during and post campaigning. **Activities-** Activities to be undertaken during the N.S.S. camp- Use of the mass media in the N.S.S activities.

### UNIT IV

4hours

**Health, Hygiene and Sanitation:** Definition, needs and scope of health education, food and Nutrition, Safe drinking water, Sanitation, Swachh Bharat Abhiyan. **Disaster Management:** Introduction to Disaster Management, Classification of Disasters. Role of Youth in Disasters Management, Home nursing, First Aid. **Civil Self Defense:** Civil Defense services, aims and objectives of civil defense, Need for self defence training

### UNIT V

10hours

**Social Project:** Problems Identification - Data Collection- Preparation of a Questionnaire-Observation-Schedule Interview-Qualitative Research-Quantities Research-Major Findings-Suggestions-Conclusion-Report Writing.

**Text Book(s):**

- 1) National Service Scheme Manual (Revised) 2006, Government of India, Ministry of Youth Affairs and Sports, New Delhi
- 2) NSS Diaries
- 3) Sanjay Bhattachaya, Social Work Interventions and Management-Deep and Deep Publications, New Delhi

## 19EMC181C: National Sports Organization (Common to all)

L T P C

0 0 2 0

National Sports Organization is intended by the Government of India to promote the development of athletics and sporting activities of the nation's youth. This activity enables physical fitness, teamwork and mental health within the students. This course teaches the rules and skills of below sports and games to the students. Each student shall be made proficient in one of the chosen sport from the below list:

1. Cricket
2. Volley Ball
3. Table Tennis
4. Foot Ball
5. Throw Ball (Only for Women)
6. Basket Ball
7. Athletics -100 Meters Run, Long Jump, Shot Put
8. Chess
9. Lawn Tennis
10. Kabaddi
11. Aerobics
12. Badminton

### Text Book(s):

1. Myles Schrag, The Sport Rules Book, 4/e, Human Kinetics, 2018
2. Dhama Prakash Jyoti, Rules. Of. Games. And. Sports, Laxmi Book Publication, 2018

## 19EMC181D: YOGA (Common to all)

L T P C

0 0 2 0

*The course is designed to enable the student to know about yoga an ancient Indian tradition. It embodies unity of mind and body; thought and action; harmony between human and nature and a holistic approach to health and well-being. It is not only exercise but to discover the sense of oneness with ourselves, the world and nature. The student will be able to learn about Yoga and practice different Yoga asana which influences his lifestyle and creating consciousness, it can help a student to deal with health issues and climate change.*

### Course Objectives:

- Familiarize the student with YOGA and ancient Indian tradition.
  - Enable the student to know the different asana their advantages and disadvantages.
  - Explain with the features of different Yoga asana.
  - Demonstrate and perform Yoga asana.
  - Enable the student to perform pranayama and meditation.
- **Introduction to Yoga:** Evolution of Yoga and Schools of Yoga, Origin of Yoga, History and Development of Yoga; Etymology and Definitions, Misconceptions, Nature and Principles of Yoga.
  - **Guidelines to yoga practice:** Prayer, warmup exercises/ loosening exercises
  - **Yoga Theory:** Therapeutic Benefits of Yoga – primitive, preventive and curative aspects of Yoga
  - **Application of Yoga to students,** Suryanamaskaras, Tadasan, Natarajasan, Vrikshasan, Padahasthasan, Ardachakrasan, Trikonasan, Bramari pranayama.
  - **Yoga for allround fitness,** Bhadrasan, Vajrasan, ArdhaUstrasana, Nadishuddhi pranayama, Navasan, Janusirasana, Paschimotthanasana, Shashankasan, Vakrasana, Bhujangasan, Kapalabhati..
  - **Meditative Postures:** Sukhasana, Ardha Padmasana, Padmasana and Siddhasana, Meditation
  - **Yoga Practice:** Makarasan, Sethubandhasana, Pavanmuktasan, Sarvangasan, Matsyasan, Halasan.

### Text Book(s):

1. Swami MuktibodhandaSaraswathi Shay G.S., Hatha yoga Pradipika, Bihar School of yoga publications, Munger, 2000.
2. Hatha Yoga Pradeepika of Svatmarama, MDNY Publication, 2013
3. Svatmarama, Swami, The Hatha yoga Pradipika/ the original Sanskrit [by] Svatmarama; an English translation [by] Brian Dana Akers. Woodstock, NY:YogaVidya.com, 2002.

### References:

3. Bharati, Swami Veda Reddy Venkata: Philosophy of Hatha Yoga (Englis), Himalayan, Pennsylvania, Hatha Ratnavali.
4. Swami Satyananda Saraswathi - Asana, Pranayama, Mudra & Bandha. Bihar School of Yoga, Munger
5. B.KS.Iyenger - The Illustrated Light on Yoga. Harper Collins, New Delhi.

**Course Outcomes:**

After completion of this course the student will be able to

- understand history and evolution of Yoga (L2).
- list different schools of yoga (L2).
- interpret the aim and objectives of yoga to students (L2).
- perform yoga asana, pranayama, and meditation (L3).

## 19VDC111: VENTURE DISCOVERY

L T P C

0 0 4 2

*India as part of its Make in India initiative has been focusing on creating incubation centers within educational institutions, with an aim to generate successful start-ups. These start-ups will become employment creators than employment seekers, which is the need of the hour for our country.*

*This common course for all the disciplines is a foundation on venture development. It is an experiential course that lets students venture and find out what is a business, financial and operating models of a business are. How to design and prototype a solution that meets their customers' needs and generate revenue for the business.*

### COURSE OBJECTIVES

- Discover who you are – Values, Skills, and Contribution to Society.
- Gain experience in actually going through the innovation process.
- Conduct field research to test or validate innovation concepts with target customers.
- Understand innovation outcomes: issues around business models, financing for start-ups, intellectual property, technology licensing, corporate ventures, and product line or service extensions.

### UNIT I

(6 sessions)

**Personal Values:** Defining your personal values, Excite & Excel, build a Team, Define purpose for a venture. Four stages: Personal Discovery, Solution Discovery, Business Model Discovery, Discovery Integration.

### UNIT II

(6 sessions)

**Solution Discovery:** Craft and mission statement, Experience design, Gaining user insight, Concept design and positioning, Product line strategy, Ideation & Impact.

### UNIT III

(6 sessions)

**Business Model Discovery:** Prototyping solutions, Reality Checks, understand your industry, Types of business models, Define Revenue Models, Define Operating Models

### UNIT IV

(6 sessions)

**Discovery Integration:** Illustrate business models, validate business models, Define company impact

### UNIT V

(6 sessions)

**Tell a Story:** Can you make money, Tell your venture story.

### Assessment methods

Task	Task type	Task mode	Weightage (%)
A1. Assignments	Individual	Report/Presentation	20

A2. Case / Project/Assignment	Groups* or Individual	Presentations/Report/Assignment	40
A3. Project	Individual/Group	Report/Pitch	40

### Transferrable and Employability Skills

	Outcomes	Assessment
1	Know how to use online learning resources: G-Learn, online journals, etc.	A1 & A2
2	Communicate effectively using a range of media	A1 & A2
3	Apply teamwork and leadership skills	A2
4	Find, evaluate, synthesize & use information	A1 & A2
5	Analyze real world situation critically	A3
6	Reflect on their own professional development	A3
7	Demonstrate professionalism & ethical awareness	A2
8	Apply multidisciplinary approach to the context	A2

### Learning and teaching activities

Mixed pedagogy approach is adopted throughout the course. Classroom based face to face teaching, directed study, independent study via G-Learn, case studies, projects and practical activities (individual & group)

### Teaching and learning resources

Soft copies of teaching notes/cases etc. will be uploaded onto the G-learn. Wherever necessary, printouts, handouts etc. will be distributed in the class. Prescribed text book will be provided to all. However you should not limit yourself to this book and should explore other sources on your own. You need to read different books and journal papers to master certain relevant concepts to analyze cases and evaluate projects. Some of these reference books given below will be available in our library.

#### ***Prescribed Modules:***

Access to NU-IDEA online modules will be provided.

#### ***Referential text books and journal papers:***

Personal Discovery Through Entrepreneurship, Marc H. Meyer and Chaewon Lee, The Institute of Enterprise Growth, LLC Boston, MA.

#### ***Suggested journals:***

Vikalpa, Indian Institute of Management, Ahmedabad

Journal of General Management, Mercury House Business Publications, Limited

Harvard Business Review, Harvard Business School Publishing Co. USA

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

	<b>COURSE Outcome</b>	<b>Assessment</b>
1	Understand conceptual framework of the foundation of a venture	A1, A2
2	Understand the concept of purpose, mission and value-add service offered by a venture	A3
3	Analyze design and positioning of the product	A3
4	Demonstrate prototyping	A3
5	Analyze business, revenue and operating models	A3

## Semester II

S. No.	Course Code	Course Title	Category	L	T	P	A	C	Remarks
1.	19EMA104	Engineering Mathematics II (Probability and Statistics)	BS	3	0	0	0	3	Common with CSE
2.	19EID134/ 19EID234	AI Tools/ Life Sciences for Engineers	ES/BS	2	0	2	0	3	Common to all
3.	19ECY131/ 19EPH131	Engineering Chemistry / Engineering Physics	BS	3	0	3	0	4.5	Common to CSE/ECE/EEE
4.	19EEE131	Basic Electrical and Electronics Engineering	ES	3	1	3	0	5.5	Common to all
5.	19EME131/ 19EME121	Engineering Graphics / Workshop	ES	1/0	0	3	0	2.5/ 1.5	Common to all
6.	19ECS237	Data Structures with Python	PC	2	0	3	0	3.5	Common with CSE
7.	19EMC181A/ 19EMC181B/ 19EMC181C/ 19EMC181D	NCC/NSS/NSO/YOGA	MC	0	0	2	0	0	Common to all
8.	19EHS122	Comprehensive Skill Development /Activity Based Learning I	HS	0	0	0	6	1	Common to all
<b>Total</b>							<b>23/22</b>		

**19EMA104: ENGINEERING MATHEMATICS-II  
(PROBABILITY AND STATISTICS)**

**L T P C**  
**3 0 0 3**

*This course is designed to impart knowledge on the concepts of Data Science, fundamental properties of probability, distributions, correlation, regression, testing of hypothesis for small and large samples in engineering applications.*

**Course Objectives:**

- To familiarize the students with the foundations of Data Science, probability and statistical methods.
- To explain the concepts in random variables and several distributions in engineering applications.
- To teach the concepts of correlation, regression and estimations and their properties.
- To explain the concept of testing of hypothesis for large samples.
- To impart knowledge on small sample tests.

**UNIT I: Data Science and Probability**

**10 L**

**Data Science:** Introduction to statistics, population vs sample, collection of data, primary and secondary data, types of variables: dependent, independent, categorical and continuous variables, data visualization, measures of central tendency, measures of dispersion (variance).

**Probability:** Probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem (without proof).

**Learning Outcomes:**

After completion of this unit the student will be able to

- summarize the basic concepts of data science and its importance in engineering (L2)
- analyze the data quantitatively or categorically, measure of averages, variability (L4)
- define the terms trial, events, sample space, probability and laws of probability (L2)
- make use of probabilities of events in finite sample spaces from experiments (L3)
- apply Baye's theorem to practical problems (L3)

**UNIT II: Random Variable and Probability Distributions**

**8 L**

Random variables (discrete and continuous), probability mass and density functions, probability distribution Binomial, Poisson, normal distribution- and their properties (mathematical expectation and variance).

**Learning Outcomes:**

After completion of this unit the student will be able to

- explain the notion of random variable, distribution functions and expected value (L2)
- apply Binomial and Poisson distributions to compute probabilities, theoretical frequencies (L3)
- explain the properties of normal distribution and its applications (L3)

### UNIT III: Correlation, Regression and Estimation

8 L

Correlation, correlation coefficient, rank correlation, regression, lines of regression, regression coefficients, principle of least squares and curve fitting (straight line, parabola and exponential curves).

**Estimation:** Parameter, statistic, sampling distribution, point estimation, properties of estimators, interval estimation.

#### Learning Outcomes:

After completion of this unit the student will be able to

- identify different trends in scatter plots, strengths of association between two numerical variables (L3)
- make use of the line of best fit as a tool for summarizing a linear relationship and predicting future observed values (L3)
- estimate the value of a population parameter, computation of point and interval estimation (L3)

### UNIT IV: Testing of Hypothesis and Large Sample Tests

8 L

Formulation of null hypothesis, alternative hypothesis, critical region, two types of errors, level of significance and power of the test. **Large Sample Tests:** Test for single proportion, difference of proportions, test for single mean and difference of means confidence interval for parameters in one sample and two sample problems.

#### Learning Outcomes:

After completion of this unit the student will be able to

- identify the difference between one-tailed and two-tailed hypothesis tests (L3)
- analyze the testing of hypothesis for large samples (L4)

### UNIT V: Small Sample Tests

6 L

Student t-distribution (test for single mean, two means and paired t-test), testing of equality of variances (F-test),  $\chi^2$  - test for goodness of fit,  $\chi^2$  - test for independence of attributes.

#### Learning Outcomes:

After completion of this unit the student will be able to

- analyze the testing of hypothesis for small samples (L4)
- test for the  $\chi^2$  square goodness of fit and independence of attributes (L4)

#### Text Book(s):

1. Richard A. Johnson, Iswin Miller and John Freund, Miller & Freund's probability & statistics for engineers, 7/3, Pearson, 2008.
2. Miller and Friends, Probability and Statistics for Engineers, 7/e, Pearson, 2008.
3. S.C. Gupta and V.K. Kapoor, Fundamentals of Mathematical Statistics, 11/e, Sultan Chand & Sons Educational Publications, 2012.

#### References:

1. S. Ross, A First Course in Probability, Pearson, 2002.
2. W. Feller, An Introduction to Probability Theory and its Applications, 1/e, Wiley, 1968.

**Course Outcomes:**

After completion of the course, the student will be able to

- classify the concepts of Data Science and its importance (L2)
- apply discrete and continuous probability distributions (L3)
- explain the association of characteristics through correlation and regression tools (L3)
- identify the components of a classical hypothesis test (L3)
- use the statistical inferential methods based on small and large sampling tests (L4)

## 19EID134: AI TOOLS

(Common to all)

L T P C  
2 0 2 3

*The surge in the production of data has led to the development of various technologies. The term “Artificial Intelligence (AI)” has become ubiquitous in everyday applications from virtual assistants to self-driving cars. Several applications such as Healthcare, Finance, Bioinformatics etc. are benefitting from the advances in the domain. The global market for artificial intelligence is going to face a phenomenal growth over the coming years with organizations across the world capitalizing on the disruptive technologies that AI is offering. This course introduces the recent applications of AI namely, Virtual Assistants, Computer Vision, along with trending topics such as Deep Learning and Reinforcement Learning. The idea of the course is to introduce the basic concepts of AI as well as latest trends in the domain. This course is envisaged to provide a basic understanding on latest developments of AI to all disciplines engineering undergraduates.*

### Course Objectives:

- To provide a basic foundation on different concepts of Artificial Intelligence.
- To investigate various applications of AI such as Virtual Assistants, Computer Vision, as well as other Smart Applications.
- Explore the scope, advantages as well as limitations of intelligent systems.
- Experiment with different machine learning concepts such as Deep Learning and Reinforcement Learning
- To expose students to the AI-intensive computing and information system frameworks.

### UNIT I

10 L

**Introduction to Artificial Intelligence:** Basics of AI. Applications of AI. Advanced search, Constraint satisfaction problems, Knowledge representation & reasoning, Non-standard logics, Uncertain and probabilistic reasoning.

Conceptual introduction to **Machine Learning:** Introduction to Neural Networks, Supervised, Unsupervised, and Semi-Supervised Learning, Deep Learning, Reinforcement Learning, Linear Regression.

Conceptual introduction to **Natural Language Processing:** Natural language Understanding, Sentiment Analysis, Segmentation and recognition.

Conceptual introduction to **Speech Recognition & Synthesis:** Speech Fundamentals, Speech Analysis, Speech Modelling, Speech Recognition, Speech Synthesis, Text-to-Speech.

Conceptual introduction to **Image Processing & Computer Vision:** Introduction to Image processing, Image Noise, Removal of Noise from Images, Color Enhancement, Segmentation, Edge Detection, Optical Character Recognition, Feature Detection & Recognition

### Learning Outcomes:

After completion of this unit, the student will be able to

- recognize various domains in which AI can be applied(L2)
- define machine learning and forms of learning(L1)
- describe natural language processing and concepts for converting speech to different forms(L2)

- identify the concepts of image processing(L3)

## UNIT II

12 L

**BOT Technologies and Virtual Assistants: Catboats:** Introduction to a Chabot, Architecture of a Chabot. NLP in the cloud, NL Interface, how to Build a Chabot, Transformative user experience of catboats, Designing elements of a Chabot, Best practices for Chabot development. NLP components. NLP wrapper to catboats. Audiobots and Musicbots.

**Virtual Assistants:** Architecture of a Virtual Assistant.

### Learning Outcomes:

After completion of this unit, the student will be able to

- analyze the architecture of a Chabot(L4)
- illustrate how to construct a Chabot(L2)
- differentiate various catboats(L4)
- interpret the architecture of a virtual assistant(L3)

## UNIT III

12 L

**Image Processing & Computer Vision:** Image - Definition and Tagging. Classification of images. Tagging. Image formation, Deep Learning algorithms for Object detection & Recognition. Face recognition, Instance recognition, Feature detection and matching, Segmentation, Recognition Databases and test sets Applications -- Feature extraction, Shape identification. Fane detection.

**Applications:** Automation, Agriculture [Crop and Soil Monitoring, grading farm produce, Predictive Analytics], Retail and Retail Security [Amazon Go], Autonomous vehicles.

### Learning Outcomes:

After completion of this unit, the student will be able to

- classify the properties of images(L3)
- interpret the concepts of image processing(L2)
- implement the methods in processing an image(L3)
- analyze and apply the concepts of image processing in automation and agriculture(L4)

## UNIT IV

12 L

**Reinforcement Learning:** Introduction to Reinforcement Learning, Game Playing [ Deep Blue in Chess, IBM Watson in Jeopardy, Google's Deep Mind in AlphaGo], Agents and Environment, Action-Value Function, Deep Reinforced Learning

**Applications: Robotics,** Gaming, Diagnostic systems, Virtual Assistants.

### Learning Outcomes:

After completion of this unit, the student will be able to

- illustrate reinforcement learning(L2)

- employ the reinforcement learning in game playing(L3)
- use reinforcement learning in agent based environment(L3)
- practice learning process in diagnostic and virtual assistant systems(L3)

## UNIT V

10 L

**Smart Applications:** Smart Manufacturing, Smart Agriculture, Smart Healthcare, Smart Education, Smart Grids, Smart Transportation and Autonomous Vehicles, Smart Homes, Smart Cities.

### Learning Outcomes:

After completion of this unit, the student will be able to

- understand the application of intelligence in various domains(L2)
- apply the artificial intelligence in various applications(L3)
- correlate the intelligence to advanced applications(L4)

### Text Book(s)

1. Tom Markiewicz& Josh Zheng, Getting started with Artificial Intelligence, O'Reilly Media, 2017.
2. Stuart J. Russell and Peter Norvig, Artificial Intelligence A Modern Approach.,Prentice Hall

### References

1. AurélienGéron, Hands on Machine Learning with Scikit-Learn and Tensor Flow [Concepts, Tools, and Techniques to Build Intelligent Systems], Published by O'Reilly Media, 2017.
2. Build an AI Assistant with Wolfram Alpha and Wikipedia in Python.  
<https://medium.com/@salisuwy/build-an-ai-assistant-with-wolfram-alpha-and-wikipedia-in-python-d9bc8ac838fe>
3. Joseph Howse, Prateek Joshi, Michael Beyeler - Opencv\_ Computer Vision Projects with Python- Packt Publishing (2016).
4. Curated Datasets on Kaggle<https://www.kaggle.com/datasets>.

## AI TOOLS LABORATORY

### List of Practical Experiments:

1. Supervisely - Perform Data Labelling for various images using object recognition
2. Lobe.ai - Build custom models using the visual tool for Object recognition and sentiment analysis that can convert facial expressions into emoticons
3. Teachable Machine - In Browser Object Recognition through Brain.JS
4. Liv.ai - App for Speech recognition and Synthesis through APIs
5. Building a Chabot using AWSLex, Pandora bots
6. Configure an existing Neural Network by manipulating various parameters involved
7. Build a virtual assistant for Wikipedia using Wolfram Alpha and Python
8. Build a Convolutional Neural Network for Cat vs. Dog Image Classification

### Online Resources:

Pytorch:

<https://pytorch.org/>

<https://github.com/pytorch>

Keras:

<https://keras.io/>

<https://github.com/keras-team>

Theano:

<http://deeplearning.net/software/theano/>

<https://github.com/Theano/Theano>

Cafee2:

<https://caffe2.ai/>

<https://github.com/caffe2>

Deeplearning4j:

<https://deeplearning4j.org/>

Scikit-learn:

<https://scikit-learn.org/stable/>

<https://github.com/scikit-learn/scikit-learn>

Deep Learning.Ai:

<https://www.deeplearning.ai/>

OpenCv:

<https://opencv.org/>

<https://github.com/qqwweee/keras-yolo3>

YOLO:

<https://www.pyimagesearch.com/2018/11/12/yolo-object-detection-with-opencv/>

nVIDIA: CUDA:

<https://developer.nvidia.com/cuda-math-library>

## **Course Outcomes**

After completion of this course, the student will be able to

- distinguish the concepts of artificial intelligence, machine learning, natural language processing, image processing. (L4)
- illustrate the architectures of Chabot and virtual assistant(L2)
- analyze image based applications by using image processing concepts(L4)
- employ reinforcement learning in different applications(L3)
- identify smart applications(L3)

## 19EID234: LIFE SCIENCES FOR ENGINEERS

(Common to all)

L T P C

2 0 2 3

*Life sciences have been introduced in to curriculum of all engineering branches. Students in engineering programs should be aware of fundamentals of biology so as to relate to their field. This course is a critical application area for engineering analysis and design, emphasizing concepts, technology, and the utilization of living things. Further it is important to know how living things work and act.*

### Course Objectives

- Introduce the molecular basis of life.
- Provide the basis for classification of living organisms.
- Describe the transfer of genetic information.
- Introduce the techniques used for modification of living organisms.
- Describe the applications of biomaterials

### UNIT I

10 L

**Introduction to Biology:** Comparison of eye and camera, flying bird and aircraft, Biological observations and major discoveries- genera, species and strains, and Classification of living organisms: Cellularity, Ultrastructure, carbon and energy sources, excretion, habitat and molecular taxonomy.

#### Learning Outcomes:

After completing this unit, the student will be able to

- summarize the basis of life (L2).
- distinguish prokaryotes from eukaryotes (L4).
- compare biological organisms and manmade systems (L2).
- classify organisms (L2).

### UNIT II

12 L

Water, Biomolecules: sugars, starch and cellulose, Amino acids and proteins, lipids, Nucleotides and DNA/RNA, structure and functions of proteins and nucleic acids, hemoglobin, antibodies and enzymes, Industrial applications of enzymes, Fermentation and its industrial applications.

#### Learning Outcomes:

After completing this unit, the student will be able to

- outline the importance of water (L2).
- explain the relationship between monomeric units and polymeric units (L2).
- explain the relationship between the structure and function of proteins (L2).
- interpret the relationship between the structure and function of nucleic acids (L2).
- summarize the applications of enzymes in industry (L2).
- explain the applications of fermentation in industry (L2).

### UNIT III

12 L

Bioenergetics, Respiration: Glycolysis and TCA cycle, Electron transport chain and oxidative phosphorylation, Mechanism of photosynthesis, Human physiology, neurons, synaptic and neuromuscular junctions.

#### Learning Outcomes:

After completing this unit, the student will be able to

- apply thermodynamic principles to biological systems (L3).
- explain the mechanism of respiration and photosynthesis (L2).
- summarize the principles of information transfer and processing in humans (L2).

### UNIT IV

12 L

Mendel's laws, gene mapping, Mitosis and Meiosis, Epistasis, single gene disorders in humans, Genetic code, DNA replication, Transcription, Translation.

#### Learning Outcomes:

After completing this unit, the student will be able to

- define Mendel's laws (L1).
- demonstrate the mapping of genes (L2).
- explain interactions among genes and their significance (L2).
- differentiate the mitosis and meiosis (L4).
- explain the medical importance of gene disorders (L2).
- identify DNA as a genetic material in the molecular basis of information transfer (L3).

### UNIT V

10 L

Recombinant DNA Technology: recombinant vaccines, transgenic microbes, plants and animals, animal cloning, biosensors, biochips.

#### Learning Outcomes:

After completing this unit, the student will be able to

- outline the principles of recombinant DNA technology (L2).
- appreciate the potential of recombinant DNA technology (L2).
- summarize the use of biological materials for diagnostic devices (L2).

#### Lab Experiments (Virtual or Field Experiments)

1. Microscopy, Mendel's laws, mapping, interactions, - 4 lab experiments
2. Nitrogen cycle, Species interactions, Sterilization, Bacterial population growth, - 4 lab experiments

#### Text Book(s):

1. N. A. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, "Biology: A global approach", Pearson Education Ltd, 2018.
2. Arthur T Johnson, Biology for Engineers, CRC press, 2011.

**Reference Book(s):**

1. Alberts Et.Al., The molecular biology of the cell, 6/e, Garland Science, 2014.
2. E. E. Conn, P. K. Stumpf, G. Bruening and R. H. Doi, “Outlines of Biochemistry”, John Wiley and Sons, 2009.

**Course Outcomes**

After studying the course, the student will be able to:

- explain catalytic properties of enzymes (L2).
- summarize application of enzymes and fermentation in industry (L2).
- identify DNA as a genetic material in the molecular basis of information transfer (L3).
- apply thermodynamic principles to biological systems. (L3)
- analyze biological processes at the reductionistic level (L4).
- appreciate the potential of recombinant DNA technology (L2).

**19EEE131: BASIC ELECTRICAL AND ELECTRONICS ENGINEERING**  
**(Common to all)**

**L T P C**  
**3 1 3 5.5**

*This course introduces the student, to the fundamental principles and building blocks of electrical and electronics engineering. The first three units cover the electric circuit laws, theorems and principles of electrical machines. The last two units cover semiconductor devices and their applications.*

**Course Objectives**

- To familiarize the basic DC and AC networks used in electrical and electronic circuits.
- To explain the concepts of electrical machines and their characteristics.
- To introduce the importance of transformers in transmission and distribution of electric power.
- To impart the knowledge about the characteristics, working principles and applications of semiconductor diodes, metal Oxide semiconductor field effect transistors (MOSFETs).
- To expose basic concepts and applications of Operational Amplifier and configurations.

**UNIT I**

**10L**

**Basic laws and Theorems:** Ohms law, Kirchoff's Laws, series and parallel circuits, source transformations, delta-wye conversion. Mesh analysis, nodal analysis. Linearity and superposition theorem, Thevenin's and Norton's theorem with simple examples, maximum power transfer theorem with simple examples.

**Learning Outcomes:**

After completion of this unit, the student will be able to

- state Ohms law and Kirchoff's Laws (L1)
- identify and analyze series and parallel connections in a circuit (L4)
- predict the behavior of an electrical circuit (L2)
- determine the current, voltage and power in the given electrical circuit(L3)
- apply various techniques to analyze an electric circuit(L3)

**UNIT II**

**10L**

**DC Machines:** Constructional features, induced EMF and torque expressions, different types of excitation, performance characteristics of different types of dc machines, Starters: 2-point, 3-point starters, losses and efficiency, efficiency by direct loading.

**Learning Outcomes:**

After completion of this unit, the student will be able to

- describe the constructional features of DC machines(L1)
- analyze EMF and torque expressions of DC machine(L4)
- demonstrate the performance characteristics of different types of dc machines (L3)
- explain types of starters used for starting of dc motors (L2)
- estimate losses and efficiency of electrical machine(L2)

## UNIT III

12L

**Transformers:** Constructional details, EMF equation, voltage regulation, losses and efficiency, open/short- circuit tests and determination of efficiency. **Three Phase Induction Motors:** Construction, working principle of three phase induction motor, Torque and Torque-Slip characteristics.

### Learning Outcomes:

After completion of this unit, the student will be able to

- describe the constructional details of transformers (L1)
- demonstrate voltage regulation of transformer (L2)
- discuss about open and short- circuit tests of transformer(L2)
- explain the working principle of three phase induction motor(L5)
- describe torque and torque slip characteristics (L1)
- estimate losses and efficiency of three Phase Induction Motors(L2)

## UNIT IV

12L

**Semiconductor Devices:** p-n Junction diode - Basic operating principle, current-voltage characteristics, rectifier circuits (half-wave, full-wave, rectifier with filter capacitor), Zener diode as Voltage Regulator; Metal oxide semiconductor field effect transistor (MOSFET): Operation of NMOS and PMOS FETs, MOSFET as an amplifier and switch.

### Learning Outcomes:

After completion of this unit, the student will be able to

- describe the device structure and physical operation of a diode (L1)
- discuss V-I characteristics of diodes (L2)
- explain the use of diode as switch and in electronic circuits(L2)
- describe the construction and operation of n-channel and p-channel MOSFETs (L1)
- explain the use of MOSFET as an amplifier and bidirectional switch(L2)

## UNIT V

10L

**Operational Amplifiers:** The Ideal Op Amp, The Inverting Configuration, The closed loop gain, Effect of Finite open-loop gain, The Noninverting Configuration, The closed loop gain, Characteristics of Non Inverting Configuration, Effect of finite open loop gain, the voltage follower, Difference amplifiers, A Single Op-amp difference amplifier.

### Learning Outcomes:

After completion of this unit, the student will be able to

- list the characteristics of an ideal Op Amp (L1)
- explain the Inverting and Noninverting configurations of Op-Amp(L2)
- construct a single Op-amp difference amplifier (L3)

## **Basic Electrical and Electronics Engineering Laboratory**

1. Verification of Kirchhoff's Laws KVL and KCL.
2. Verification of DC Superposition Theorem.
3. Verification of Thevenin's Theorem and Norton's Theorem.
4. OCC and External characteristics of separately excited DC generators.
5. Swinburne's test on a DC shunt motor.
6. OC and SC Tests on single phase transformer.
7. Brake Test on DC shunt motor.
8. Current Voltage Characteristics of a p-n Junction Diode/LED.
9. Diode Rectifier Circuits.
10. Voltage Regulation with Zener Diodes.
11. Design of a MOSTFET amplifier and MOSFET inverter/NOR gate
12. Inverting and Non-inverting Amplifier Design with Op-amps.
13. Simulation experiments using PSPICE
  - a. Diode and Transistor Circuit Analysis.
  - b. MOSFET Amplifier design.
  - c. Inverting and Noninverting Amplifier Design with Op-amps.

### **Text Book(s):**

1. D.P.Kothari, I.J.Nagrath, Basic Electrical and Electronics Engineering, 1/e, McGraw Hill Education (India) Private Limited, 2017.
2. B. L. Theraja, Fundamentals of Electrical Engineering and Electronics, 1/e, S. Chand Publishing, New Delhi, 2006.
3. Adel S. Sedra and Kenneth C. Smith, Microelectronic Circuits, 6/e, Oxford University Press, 2014.

### **References:**

1. S.K. Bhattacharya, Basic Electrical and Electronics Engineering, Pearson Education, 2011.
2. Dharma Raj Cheruku, B T Krishna, Electronic Devices and Circuits, 2/e, Pearson Education, 2008.
3. R.K.Rajput, Basic Electrical and Electronics Engineering, University Science Press, New Delhi, 2012.

### **Course Outcomes**

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

- predict and analyze the behavior of an electrical circuit (L3)
- analyze the performance quantities such as losses, efficiency and identify applications of DC machines(L4)
- explain the use of transformers in transmission and distribution of electric power and other applications (L2)
- demonstrate the operation and applications of various electronic devices (L2)
- construct Inverting and Noninverting configurations of Op-Amp (L3)

## 19ECS237: DATA STRUCTURES WITH PYTHON

L T P C

2 1 3 3.5

*The study of data structures, a fundamental component of a computer science education, serves as the foundation upon which many other computer science applications are built. Knowledge of data structures is a must for students who wish to work in design, implementation, testing or maintenance of any software system. Organization of data in an efficient way for application, is the major focus of the course.*

### Course Objectives

- Introduce various data representation methods and searching methods.
- Familiarize with linear data structures and operations on them.
- Demonstrate the organization of data as trees and various operations on trees.
- Teach various graph representations.
- Enable to perform graph traversal and find shortest path and minimal spanning tree for a graph
- Expose common sorting techniques and their complexities.

### UNIT I

10 L

**Python Primitives:** Python overview, Objects in Python, Expressions, Operators and Precedence, Control Flow, Functions, Simple Input and Output, Exception handling, Iterators and Generators, Collections [Strings, Lists, Tuples, Dictionaries].

#### Learning Outcomes:

After completion of this unit, the student will be able to

- summarize various ways of representing data (L2)
- explain the working of linear and binary search algorithms (L2)
- compare various data representations and search algorithms (L2)

### UNIT II

10 L

**Algorithm Analysis:** Asymptotic Analysis and Big O Notation **Recursion:** What is recursion, examples [Factorial functions, Fibonacci series]. **Array Based Sequences:** Python Sequence types, low-level arrays, dynamic arrays, efficiency of python's sequences, using array-based sequences. **Searching:** Sequential Search, binary search and algorithmic analysis. **Sorting:** Insertion sort, selection sort, bubble sort

#### Learning Outcomes:

After completion of this unit, the student will be able to

- summarize various ways of representing data (L2)
- explain the working of linear and binary search algorithms (L2)
- compare data representations and sorting algorithms (L5)

### UNIT III

10L

**Sorting:** quick sort, merge sort and their algorithmic analysis. **Linked lists:** Single linked list, double linked list, circular linked list **Stacks:** Definition, operations: array implementation, linked list implementation. **Queues:** Definition, operations: array implementation, linked list implementation and applications, Priority Queue. Double-Ended Queues.

## Learning Outcomes:

After completion of this unit, the student will be able to

- discuss how stacks and queues are implemented using arrays and linked lists (L2)
- explain the implementation of priority queues (L2)
- list the applications of stacks, queues and priority queues (L1)
- compare different types of linked lists (L5)

## UNIT IV

10 L

**Trees:** Definition, Tree properties, **Binary trees:** properties, implementation, tree traversals, Heap tree, Heap sort **Search Trees:** binary search tree, AVL trees and operations on AVL trees, and (2,3)-Trees

## Learning Outcomes:

After completion of this unit, the student will be able to

- discuss the properties of trees, binary, binary search and AVL trees (L2)
- explain how operations such as insertion, deletion and traversal are performed on different types of trees (L2)
- analyze the complexity of operations on different tree types (L4)

## UNIT V

10 L

**Graphs:** ADT, data structure for graphs, graph traversal, Transitive closure, directed acyclic graph, shortest paths [weighted graphs, dijkstra's algorithm], minimum spanning trees [Prim's, Kruskal's, disjoint partitions, union-find structures].

## Learning Outcomes:

After completion of this unit, the student will be able to

- demonstrate different graph representations and operations (L2)
- illustrate the working of common sorting algorithms (L2)
- analyze the computational efficiency of algorithms for sorting (L4)

## Text Book(s):

1. Michel T. Goodrich, Roberto Tamassia, Michel H. Goldwasser, **Data Structures & Algorithms in Python**, Willey March, 2013. ISBN: 978-1-118-29027-9.
2. Rance D. Necaie, **Data Structures & Algorithms using Python**, John Willey & Sons, India. ISBN 9788126562169.

## References

1. Wesley J.Chun, Core Python Programming, 2/e,Prentice Hall.
2. Manohar Swmynathan , Mastering Machine Learning with Six Steps , Apress, ISBN-13: 978-1-4842-2866-1
3. José Unpingco, Python for Probability, Statistics, and Machine Learning , Springer ISBN 978-3-319-30717-6 (eBook)
4. Reema Thareja, Python Programming using problem solving Approach, Oxford University, Higher Education Oxford University Press, First edition, ISBN-10: 0199480173,10 June 2017.
5. John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded

Edition, MIT Press, 2013.

6. Kenneth A Lambert, Fundamentals of Python first Programmes, Copyrighted material, 1/e, Course Technology Inc., 6th February 2009.
7. John B. Schneider Shira Lynn Broschat Jess Dahmen, Algorithmic Problem Solving with Python.

### **Course Outcomes:**

After Completion of this course, the student will be able to:

- explain various ways of representing data in a computer (L2)
- demonstrate operations on linear data structures (L2)
- illustrate the mechanisms for creating, altering and traversing various types of trees (L2)
- explain the representations, traversals and applications of graphs (L2)
- analyze common sorting algorithms (L4)
- choose a data structure that gives the best performance for a given application (L6)

### **DATA STRUCTURES WITH PYTHON LABORATORY**

*This Lab provides hands-on experience in designing, implementing, and using the most – commonly used data structure including arrays, stacks, queues, linked lists, trees, hash tables and graphs. Implementation of different searching and sorting algorithms is also done.*

#### **List of Practical Experiments:**

1. Python sample programs for practice
  - Find minimum among three numbers.
  - Find the GCD and LCM of two/three numbers
  - Check whether the given number is perfect
  - Print Twin Primes up to a Specified limit.
  - Print the prime numbers up to a specified limit.
  - Find the sum of digits of a number. Check whether given number is Armstrong number or not.
  - Swapping of two numbers
  - Performs all the five arithmetic operations.
2. Write a program to read a linear list of items and store it in an array.
  - Copy the contents from one array to another array
  - Copy the contents from one array to another array in reverse order
  - Delete the duplicate elements from an array.
3. Write programs for:
  - Representing sparse matrix
  - Sparse matrix addition
  - Sparse matrix transpose
4. Write a program to Perform Linear Search and Binary Search on a list stored in an array.
5. Write a program to create a singly linked list for the following operations
  - Insert a Node at Beginning, at Ending and at a given Position
  - Delete a Node at Beginning, at Ending and at a given Position
  - Search, Count the Number of Nodes and Display
6. Write a program to create a doubly linked list for the following operations
  - Insert a Node at Beginning, at Ending and at a given Position

- Delete a Node at Beginning, at Ending and at a given Position
  - Search, Count the Number of Nodes and Display
7. Write a program to create a Circular singly linked list for adding and deleting a Node.
  8. Write a program to create a stack and perform various operations on it.
  9. Write a program to convert the infix expression into postfix form.
  10. Write a program to create a queue and perform various operations on it.
  11. Write a program to create a binary tree and perform various traversals.
  12. Write a program to create a binary search tree and perform search operation.
  13. Write a program to implement Depth First Search, Breadth First Search traversals on a graph.
  14. Write a program to implement Dijkstra's Shortest Path Algorithm
  15. Write a program to implement various sorting techniques: [Compare with Python's Built-In Sorting Functions also]
    - Insertion sort
    - Selection Sort
    - Bubble Sort
    - Merge Sort
    - Quick Sort

## 19EHS122: COMPREHENSIVE SKILL DEVELOPMENT /ACTIVITY BASED LEARNING I

L T P A C  
0 0 0 6 1

### Course Objectives:

- To encourage the all-round development of students by focusing on soft skills, Coding & domain skills.
- To make the engineering students aware of the importance, the role and the content of soft skills, Coding and domain skills through instruction, knowledge acquisition, demonstration and practice.
- To develop and nurture the soft skills, coding and domain skills of the students through individual and group activities.
- To expose students to right attitudinal and behavioral aspects and to build the same through activities

Stream	Course Code	Course Title	Category	L	T	P	C
Comprehensive Skill Development	19EHS122	Soft Skills And Quantitative Aptitude	HS	1	2		1
		Coding	HS			3	
Total number of hrs per week						6	

### Part-1

#### *A. Verbal and Soft Skills*

Self Awareness and Motivation, Goal Setting and Time Management, Interpersonal Skills, Team Work.

#### *B. Quantitative Aptitude and Reasoning*

Puzzles, Non-Verbal Reasoning, Data Sufficiency, Analytical Reasoning,

### Part-2

**Coding: GitHub** – Accepting assignments pull and push the code or resource, GitHub configuration,

**Visual Studio code** – Configuring, integrating Git for assignment submission

**Online competitive coding platforms** – Introduction to online coding platforms to get prepared for competitive coding.

**Problem Solving with Python:** Collections, Techniques for manipulating Strings, Recursion, Searching, Sorting, Stacks and Queues.

**Problem Solving with C:** Memory, C Syntax, Conditions and Loops, Functions and Recursion, Arrays, Techniques for manipulating Strings, Searching, Sorting, Stacks and Queues, Structures.

**Course Outcomes:**

On completion of the course, student will be able to

- effectively communicate through verbal/oral communication and improve the listening skills.(L3)
- write precise briefs or reports and technical documents, actively participate in group discussion / meetings / interviews and prepare & deliver presentations. Become more effective individual through goal/target setting, self-motivation and practicing creative thinking. (L6)
- understand the problems and develop his competitive coding skills. (L2)
- apply the skills in various domains and will be able to solve complex problems faced by the industry(L3).
- function effectively in multi-disciplinary and heterogeneous teams through the knowledge of team work, Inter-personal relationships, conflict management and leadership quality. (L4)